MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE

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GREAT PLANES F-4
A Phantom for the sport flyer

CAP 232
LANIER'S 81-inch aerobat

T-33 Shooting Star
KYOSHO'S ducted-fan electric

- HANGAR 9'S **Cessna 182**
Scale detail in an ARF

CONSTRUCTION

Big electric Nieuport 12

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ON THE COVER: main image— Rick Bell puts the new Top Flite F-4 Phantom through its paces (photo by Gerry Yarrish). Inset: Martin Irvine tells you how to build his giant-scale Nieuport 12.

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The Golden Age is Now

People often write about the Golden Age of model aviation. They make reference to the large numbers of people who were involved in the hobby in the '30s and '40s and to all the general interest in the population. Indeed, this was a time where everyone was in love with airplanes, many discovering them for the first time. Air travel was an adventure, and you actually walked out and climbed into an airplane rather than walking down a tube so you could sit in another tube, eating peanuts while being whisked across the country. So it's easy to be convinced that this era of aviation popularity was also the best of times for modelers.

But I think this depends on your perspective. I would like to suggest that now are the golden years of model aviation. I know, I know; this is our April issue, but this is not an April Fool's editorial. I'm quite serious in my view, and I'll try to provide some reasons for it.

First and foremost is the availability of products and materials for us to do what we enjoy. Just think of the options available to us. We can build with balsa and ply just as those who crafted models in the '40s did; it's still my favorite way to build a model. But we've also got foam, carbon fiber, plastics and fiberglass. Just think about what possibilities were opened up by the implementation of each of these materials. When Ed Izzo showed us all how to cut wing-cores, a large door opened and people walked through, especially those interested in building large warbirds and such. Because of plastics, we're now able to more easily detail scale planes and, not surprisingly, the popularity of scale models is at an all-time high. Carbon fiber allows the production of very light, strong airframes that have quite literally revolutionized areas like pylon racing, Wakefield and competition sailplanes. You don't have to look far on the flightline before coming across an example of a model with a fiberglass fuselage—another material/method that has increased the popularity of scale models. High-performance sailplanes are completely dominated by glasswork, as it brings both looks and strength to low-drag airframes. None of these options were available in "the good old days."

While on the subject of materials, what about plastic, heat-shrink covering material? Most modelers are so sold on this method of covering that they know no other method. And why not? For sport flyers, there's no easier way to get a bird flying. Without these coverings, ARFs wouldn't have been possible.

But it's not just materials that have improved. We take our radio equipment for granted, yet it didn't even exist in that "other" Golden Age when everything was free flight. Think about the vast array of hardware options available to the modeler today. They line hobby shop walls, and the vast majority of them are first class. It could be argued that most of this stuff wasn't necessary in the '30s and '40s, as people flew only free-flight planes that required little in the way of hardware. This is true, but this is exactly why I argue that now is the Golden Age of modeling.

The variety of hardware is a reflection of the vast number of choices we modelers have when it comes down to deciding which kind of model to build. Here, I don't mean a choice between a P-51 or a Piper Cub, though those choices are real enough. What I'm talking about is more basic. In the '30s and '40s, the choice was pretty much either free flight or static models. Granted, control-line took the modeling world by storm during this time, as you could "feel" your model flying. But even within the ranks of free-flight and control-line, the options were more limited than today, and today, we have all the R/C possibilities available to us.

Today, free-flight runs the gamut between very slow flying, rubber-powered planes that fly for an hour indoors and virtual rockets that climb vertically, eventually transitioning to a glide. Control-line aficionados fly pretty much everything and anything that can be flown, still gaining that truly exciting feeling of control while feeling the aircraft respond to their commands. And we have radio-control models that are very small (people are putting R/C gear in 13-inch-wingspan peanut-scale planes) and others that are very large. Slow-flying indoor R/C planes are becoming popular and now fly upwards of four hours indoors on lithium cells; 250mph turbine-powered jets are becoming commonplace at scale meets. The variety is remarkable; the choices many.

Just some of the action captured at the USRA Champs.

With the availability of great materials and great hardware and having the ability to build and fly nearly any model desired, what more could a modeler possibly ask for? Well ... maybe we could lobby for more time.

IN THIS ISSUE

And speaking of choices, in this issue, Debra Sharp brings us coverage of USRA scale racing—the upper crust of the model racing world. These big-bird races bring out the best in fiberglass/carbon-fiber construction and airframe design to produce powerful heart-stopping performance as the planes race Reno-style over the desert. Check it out as Deb shares the excitement of going fast and turning left.

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

AIR SCOOP

BY CHRIS CHIANELLI

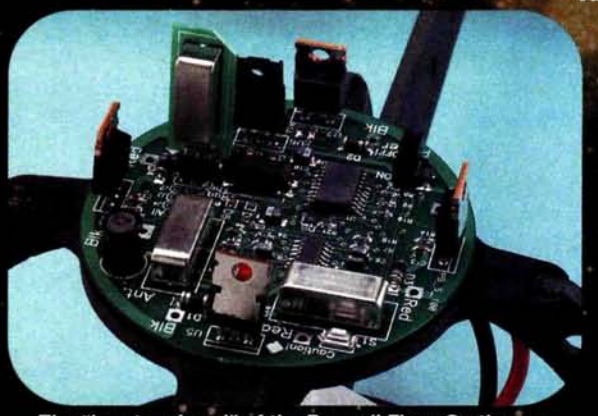
A . F . O . T .

ROSWELL FLYER

After a long period of silence followed by many ambiguous denials, AFOT (Area Fifty One Technology) has now come clean with its top-secret Roswell Project. I guess it was the spy shot that made them finally "fess up."

Well, guys, here it is, close up: the 22.25-inch-diameter from strut tip to strut tip Roswell Flyer. You're right; this isn't the first four-point hovercraft. There is a similar design that is smaller and uses mechanical gyroscopic control.

The big difference with the Roswell Flyer is not its "bigness" but those three Pez-candy-shaped silver canisters. Within each one lies the smallest piezometric crystal gyroscope I've seen enter our hobby thus far. The three are dedicated to roll, pitch and yaw axes. When compared with mechanical gyros, piezo types are lighter, have a much faster response time and have a far lower current drain, so more of the onboard battery capacity can be used for powering the drive motors. In short, flight duration is dramatically improved. Couple the foregoing facts with the Roswell's larger size than preceding gyroscopically controlled hover craft, and the Roswell should be one excellent flyer. Stay tuned to *Model Airplane News* (or "The X-Files") for further information on and/or microfilm enlargements of AFOT's Roswell Flyer. On the other hand, since the "cat" (or should I say saucer) is out of the bag, I suppose you could just contact the friendly guys at AFOT at Impulse Inc., 7250 Peak Dr., Las Vegas, NV 89128; (702) 948-1100; order line (800) 328-0184; website: www.afot.com.



The "heart and soul" of the Roswell Flyer. On the perimeter of the circuit board, you can see four MOSFETs: one each for the electronic speed controlling of each motor. The three silver canisters are the piezo crystal gyros for roll, pitch and yaw axis. Your radio's receiver plugs into this board, and no servos are required anywhere. Any 4-channel radio will serve nicely.

Here you can see the size of the piezometric crystal gyros compared to a pencil eraser. AFOT has future technological surprises in store for us modelers I'm sure.

This is my good German friend and "head honcho" of Graupner—maker of the finest high-tech glider in the world—enjoying his 70th birthday by flying the new Graupner Discus-2 while on vacation in the Dolomites of Italy.

From his bright clothing to his cheerful personality, his eminence is always fun to be around. Happy birthday, Mr. Graupner. You don't look a day over 29!

Frohe Geburtstagsfeier, Herr Graupner!

JR DIGITAL SERVO

As technology has advanced in the area of radio control, so has the need for powerful, precise servos that are up to the challenge of today's sophisticated models. In answer to the call, JR introduces its new DS8231 Digital Servo—the first in a new line of digital servos to come.

Typical analog servos have a power pulse of 50Hz (50 power pulses per second); the DS8231, however, will feature a power pulse of approximately 300Hz, which, according to JR distributor Horizon Hobby Distributors, gives it more than five times the holding power of an analog servo. By using more efficient field-effect transistors, or FETs, the DS 8231 achieves this tremendous holding power with only a slightly higher current drain (on average, about 8 percent more under load). It also delivers 100 percent of its torque immediately off center, thanks to its high resolution (as much as 5,900 steps per 120 degrees) and deadband of less than 0.001 milliseconds. This deadband/resolution combination dramatically improves the accuracy of the control position under even the toughest loads.

As for compatibility, JR's new digital servos will operate on a wide range of voltages, allowing the use of just about any of today's popular 4.8V or 6V receiver packs. In addition to being sold separately, the new DS8231 will also come as standard equipment with JR's new PCM 10X 10-channel Programmable Radio System.

Horizon Hobby Distributors Inc., 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9511.

SUPER-FAST SUPER STEARMAN

I'm so happy to report that the Kyosho people have added their first biplane to their superb Super Quality Series line of ARF kits. Based on the venerable Boeing PT-17 WW II trainer, the Super Stearman is certainly an icon of aviation and a perfect choice, in my humble opinion, for Kyosho to have made. Like the rest of the Super Quality Series, the 90-percent-pre-assembled Super Stearman is finely crafted from balsa and plywood and, as a result, has a fantastic wing loading of only 17.6 ounces/square foot. With such a loading, this should be one great flying model. The Stearman comes finished with iron-on covering just as you see it here, and the fiberglass cowl and wheel pants are hand-painted to match. Wheels, fuel tank and engine mount are included. Specs: wingspan—49.4 inches; upper wing area—366 square inches; lower wing area—351 square inches; weight—5.5 pounds; length—39 inches; engine required—.40 to .46 2-stroke, or .48-.52 4-stroke.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL; (217) 398-6300; fax (217) 398-0008.

GLOBAL HOBBIES ARF-F4U

This powerful Navy/Marine killing machine struck terror into the enemy once its awesome capabilities became evident.

Everybody grew to love the Corsair, save those who ended up in its sights. The Japanese nicknamed it "Whistling Death." For you Corsair-loving modelers, the F4U has just become a bit more appealing, thanks to Global Hobbies because its F4U is a built version. Global's ARF Corsair features a one-piece inverted gull wing, fully rounded fuselage, sag- and wrinkle-free polyester film covering, matching prepainted fiberglass cowl, balsa plywood and foam construction and built-in servo bays for each aileron.

Specs: wingspan—53 inches; wing area—500 square inches; length—41 inches; flying weight—5 to 5.5 pounds; engine requirement—.46 to .60 2-stroke, or .52 to .65 4-stroke.

Global Hobbies, 18480 Bandilier Circle, Fountain Valley, CA 92728-8610; (714) 964-0827; fax (714) 962-6452.

HOBBY LOBBY Nora

Voted "Model of the Year" in the Czech Republic! The Nora is a pretty little design that, being one of Hobby Lobby's Parkflyer Series, can be flown almost anywhere. It flies up to 15 minutes on a 300mAh battery pack and does wheel takeoffs, landings and minor aerobatics.

The fuselage and cowl are of ultra-lightweight fiberglass and have details molded in. The wing is a balsa rib/spar affair that is covered to match the fuselage. The Nora has nice prefab touches, such as predrilled mounting holes for its landing gear and lightweight wheels plus pushrods that are already installed. I'm told by Hobby Lobby that the model is a hand-built work of art!

The kit includes a Speed 280 motor (GR6328), gearbox, special prop, spinner and wheel pants. Specs: wingspan—42 inches; length—24 inches; wing area—340 square inches; weight—about 16 ounces. Here's the best part: price is only $116!

Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.

Big "B" COMES IN GOLD

Top Flite has introduced an 84.5-inch-wingspan P-51B Mustang to its Gold Edition line. This is not a conversion kit for the "D" kit; this a totally dedicated kit. I'm glad Top Flite is giving the "B" the attention it deserves. After all, it was the "B" version, not the "D," that first escorted Allied bombers deep into unfriendly territory. Like other kits in the Gold Edition line, the "B" features interlocking parts and familiar wooden kit techniques. From its distinctive turtle deck to the radiator scoop, Top Flite has created the vintage "B" look in the Gold Edition style that has become respected in the hobby. An optional scale cockpit interior adds a seat, harness, instrument panel and control levers. The instructions show flap and retract installation. Specs: wingspan—84.5 inches; wing area—1,245 square inches; weight (with radio)—18 to 19 pounds; wing loading—32 to 35 ounces/square foot; length—73.5 inches; engine requirement—2.1 to 2.8ci glow, or 2.5 to 4.2ci gasoline ignition.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL; (217) 398-6300; fax (217) 398-0008.

EASILY UNORTHODOX

CROSSBOW

Leading Edge Model Aircraft Inc. is a new company whose prime directive is to bring the average weekend sport flyer totally original designs that, while being unique, are easy to build and fly. The new Crossbow certainly appears to adhere to the company's stated mission. Construction techniques, on the other hand, are purely conventional. The Crossbow is a balsa and plywood structure from rudder post to spinner ring. According to the manufacturer, the flat-bottom, fully sheeted wing is strong and provides a safety margin of lift while the rudder, elevons and winglets provide solid control. All hardware is high-quality Du-Bro brand, including the mechanical mixer for the elevons. Specs: wingspan—52 inches; length—46 inches; 4-channel radio required; engine requirement—.35 to .46 2-stroke.

Leading Edge Model Aircraft Inc., 17 Boxwood Rd., Port Washington, NY 11050; (877) 431-3183.

AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," MODEL AIRPLANE NEWS, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

BEC'S FOR *BRAKING*?

I read your "Current Thoughts" article on speed controls in the November issue, and I really appreciate the way in which you made a complicated subject understandable to those of us who are not well versed in electronics. I've built and flown glow for many years. My only experience with electrics was when I stuck two of my fingers into the prop while hand-launching a pusher for a fellow flier. I immediately came to appreciate the power of electrics.

Now I have a dumb question: I recently discovered that a young friend of mine has a Great Planes Spectra—built a couple of years ago but never successfully flown. I offered to fly it, and it flew beautifully until it was time to land. When I shut the motor off, the prop continued to windmill. Of course, on landing, this bent the motor shaft. I suggested that my friend buy a folding prop. I noticed at the end of your article on BECs that braking for folding props can be a function of a BEC. What am I missing here? The motor control in the Spectra is just a servo-controlled on/off switch. Will a folding prop fold if you just shut off power to the motor, or is braking necessary to stop rotation?

I know these are pretty basic questions, but we live in the mountains of Idaho and have no one nearby to ask. This time of the year would be a great time for electrics with no gear. The ground is too soft to roll our landing strip for wheel use and the snow has all melted, so skis aren't an option. [email]

LLOYD KNERR

The brake is not a part of the BEC. To obtain the braking feature, you have to be using an electronic speed control that has the brake feature. You can't do this if your motor control is a servo-controlled switch. Not all speed controls have brake; you have to specifically purchase one with this feature.

As for how it works—without going into a lot of deep detail: there is an extra FET transistor in the control, and it is turned on when the throttle is off. Instead of applying power to the motor, this "brake FET" actually shorts out the motor terminals. Since the prop is windmilling, it is effectively trying to make the motor act like an electric generator. To this "generator," the short across the motor terminals looks like a really big load—one that it cannot easily turn. Because the motor doesn't turn—or at the most turns slowly—the airflow causes the prop blades to fold, since they can no longer "fly."

—Tim McDonough

IN MEMORIAM

William J. Winter

1912–1998

Mere words can't describe this man. To call him a visionary is not enough. To call him a legend in his own time is not enough. He's my friend, and my brother.

—from "Tales of an Ancient Modeler," by Norm Rosenstock

Through his love of aviation, Bill Winter came to influence all aspects of model aviation as we know it today, and he continues to do so. Bill has designed and published hundreds of quality models. He helped thousands of modelers get their designs to the public. He influenced millions of people with his editing and writing. While seeing himself as a coordinator of everybody else's ideas, Bill garnered the highest respect of everyone who knew him as a creative designer and as a considerate person.

Working with Bill Winter has been the opportunity of a lifetime and the highlight of my modeling life. Before he passed away, Bill discussed with me his complete satisfaction with what he had accomplished in his life through model aviation, for he is truly the most respected man in the field. Bill was the bridge from the beginning days of model aviation to the present, bringing the best out of so many people and adding it to the betterment of so many. As far as I am concerned, Bill Winter continues to live through his designs and his shared wisdom. Perhaps he wanted to build an immortality of this kind, especially when he kept on designing for all of us during his later years.

John Hunton

Modeling has lost one of the few men who were instrumental in founding and creating what model aviation is today. A friend to all modelers, William "Bill" Winter was a proficient and knowledgeable writer who also could edit well. To our benefit, Bill was also an ardent modeler and remained so to the very end of his long life. His modeling began in the rudimentary rubber-power days and never let up. He was one of the very few who have lived and breathed modeling from the beginning and lifelong.

Winter's avocation led him to editing *Model Airplane News* in its early stages. He held the same position with *Air Trails*, *American Modeler*, *Grid Leaks* (Ace R/C) and numerous annuals and books. Winter's editorship guided those media into channels that provided the sorely needed information to create model aviation's growth. His efforts were outstanding! It seems appropriate to say William Winter was model aviation's godfather.

My fortunate association with Bill is an excellent example of how his influence contributed. If I can say my modeling career is successful, to a major extent, my longtime friend has also been responsible.

Bill was a great man and modeler; certainly, my portion in his life was a small one. Many others enjoyed his association, as he spread his goodness widely.

It should be obvious that I sadly lost a very close compadre. I hope the model aviation community will share this loss and say some prayers for its passed-on godfather.

Hal deBolt

HORIZON MODELS OTTER

We published a photo of Rodolfo Caceres' Horizon Models Otter in our January 1999 "Pilot Projects," and we've been deluged with requests for the whereabouts of Horizon Models. It is a Canadian company and can be reached at: Horizon Models, 1088 RR #2, Three Fathom Harbor, Nova Scotia, B0J 1N0 Canada; (902) 889-3212; fax (902) 889-3017.

½A AIRCRAFT

While I was sizing up some kits for conversion to electric power, I came across something that I see all too often and have no idea what it really stands for. A friend of mine says it stands for ½ Aerobatic (rudder and elevator, or aileron and elevator). The plane can be any size. I don't buy it. For one, I have never seen a large aircraft labeled ½A. They always appear to be "small" (a relative term). But, if ½A just means small, at what size does something grow out of a ½A label? [email]

JOHN CSERNEK

Your friend has a good imagination. In reality, ½A is a reference to a class of free-flight planes powered by .049 engines. It came about because free-flight classes were designated A, B and C, with these classes determined by engine displacement. When people decided to create a class for .049s, they called it ½A. If you look closely at the literature, you may even see references to ¼A, which is a class for .020ci engines. In practice, however, the term has been generalized to any plane powered by .049s, and some even use the term to refer to airplanes powered by small engines in general. LM

WANTS LOCKHEED NEPTUNE PLANS

I received my January copy of *Model Airplane News* and was pleased to see a listing of plans. I eagerly scanned the list looking for the P2V Neptune patrol aircraft. Again, I have been disappointed by not finding it. I have looked high and low for a set of plans for the Neptune, but it seems it is not very popular. It's of great interest to me because I spent many hours over the Pacific in that aircraft—sometimes up to 12 hours a hop.

I don't know why this aircraft is not featured. It was used in the Korean conflict and later. I have seen pictures of it used during the Cuban missile crisis. We also flew it out of NAS Alameda, CA, and did patrol duty out of Christmas Island during the nuclear testing in the early '60s.

I really enjoy your magazine. I like the new wave of electric-powered models.

TOM VAN MATER
1339 Rose Ave.
Modesto, CA 95355

The Neptune is a pretty plane; there's no doubt about it. The reason you don't see many plans, I think, is mostly because the Neptune is a multi-engine aircraft, and there are darn few designs available for multi-engine models due to their complexity. We're seeing a lot more multis being done these days, mostly because of electric motor reliability and, in giant scale, the reliable performance of gasoline engines. I've done some looking and can't find any plans for the Neptune, so I've included your address so that maybe one of our readers will be able help you. LM

PILOT PROJECTS

A look at what our readers are doing

SEND IN YOUR SNAPSHOTS. ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

GIANT AEROBAT

Frank Pace of West Islip, NY, built this 73.5-inch-span Giant Aeromaster from a Great Planes kit and finished it with Solartex fabric and Krylon paint and custom vinyl. A Quadra .65 engine swinging a Zinger 22x6-10 prop provides 80 to 90mph flight speeds and exceptional climb-out. Frank says, "I designed the red, white and blue Stars and Stripes finish with a little inspiration from watching the U.S. Olympic team in last year's winter games."

MISS PATTERSON

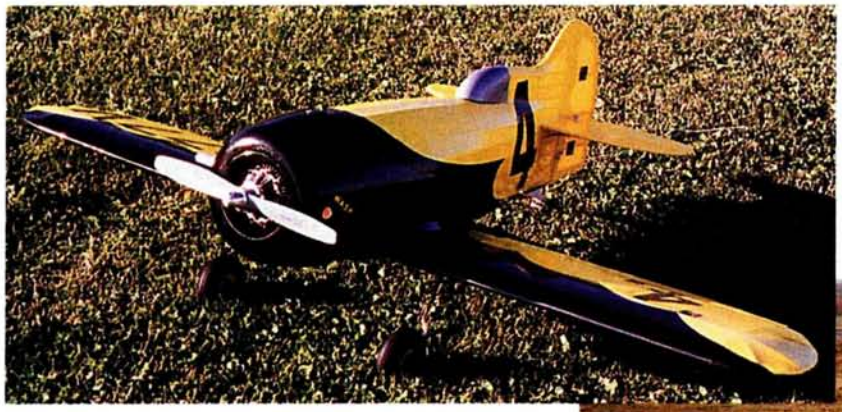
Christoph Leluschko of Greven, Germany, spent a year building this Wedell Williams racer from Wendell Hostetler plans. The model has homemade wheel pants, cowl and gear and is powered by a 50cc Husquevarna engine swinging a 21x12 Menz propeller. It's covered with Super Coverite and automotive paint. Christoph writes, "I painted it in the 'Miss Patterson' version [and used] decals from Byron. The model is a bit heavy [22 pounds] but it flies great."

AROUND THE WORLD

On a trip to Lockhaven, PA, to visit the Piper Aviation Museum, Bob and Marie Berryman of Lake Charles, LA, saw *City of the Angels*—a full-size Piper PA-12 that flew around the world in 1947. The Berrymans' model has an 80-inch wingspan, weighs 7½ pounds and is powered by a Saito 56 engine. Like its full-size counterpart, the model features flags of each of the countries in which *City of the Angels* landed.

SOUTH AMERICAN MODELING

Jose Arango is a commercial airline pilot and avid R/C'er living in Bogota, Colombia. He built the Sopwith Camel from a VK/Proctor kit and the Fokker from a Flair kit. Both models are powered by O.S. 70 Surpass engines and covered with Sig Koverall, dope and paint. Both also feature pull/pull controls on all flying surfaces. Jose writes, "They fly great and, I'm sure, similar to the originals; they also require quite a bit of maintenance after flying."



MODEL Z

Duane Powers of Duanesburg, NY, "bashed" this Hobby Hangar .20 Gee Bee so it would look like the Model Z. The model is powered by an O.S. .30 Wankel engine turning a Graupner 10x5 prop, and it's covered with 21st Century fabric. Duane notes that he made the cowl out of a Rubbermaid bowl and says that the airplane "flies like a sport model and cooks at 85mph."

SUPER SPORTSTER TWIN

This unique model is the brainchild of Jerry Cerney of Oklahoma City, OK. Jerry won a .20 Super Sportster kit 10 years ago and decided, only seven months ago, to build it into a twin model powered by two O.S. .25 engines. The model weighs nearly 7 pounds and is sheeted and glassed with ½-ounce cloth and painted with LustreKote. Jerry adds, "In case anyone wonders about the wing loading, [in addition to] many changes to the kit, the length of the wing was increased from 48 to 56 inches."

MILITARY TRANSPORT

Javier Sierra sends us a photo and greetings from Guadalajara, Mexico. Javier spent three months building the DC-3/C-47 from Nick Ziroli plans. Two Zenoah G38 engines provide the power, and the finish is epoxy/glass.

R/C PLAYBOY

B.B. Weber of Houston, TX, tells us that his favorite free-flight model has always been the Senior Playboy. For this model, he used a Playboy wing and stabilizer, enlarged the vertical fin and rudder and built a lifting-body fuselage that's undercambered like the wing. It's powered by two .15 2-strokes and weighs 4 pounds. B.B. writes, "It doesn't climb as fast as a single .32 engine, but the glide ratio is unbelievable, and it sounds like a couple of mad bees at takeoff."

ITALIAN CANADAIR

Guiliano Bidussi of Trieste, Italy, scratch-built this 6-foot-span CL-215 from Steve Gray plans. The model uses two O.S. .46LA engines and is painted in the markings and insignia of the Italian Protezione Civile.

CANADIAN TIGER MOTH

Don Madison of San Diego, CA, writes that this DH 82A model started as an old Pilot kit he found in a friend's attic. The 50-inch-span model weighs 5½ pounds, uses an O.S. Max .40FP for power and is finished with Solartex covering and Chevron paints. Don tells us that he became so interested in Tiger Moths that he spent four hours in the San Diego Aerospace Museum library researching this project. He eventually decided on a paint scheme used on a Tiger Moth that was made in Great Britain in 1937 for the Canadian Air Force.

HINTS & KINKS

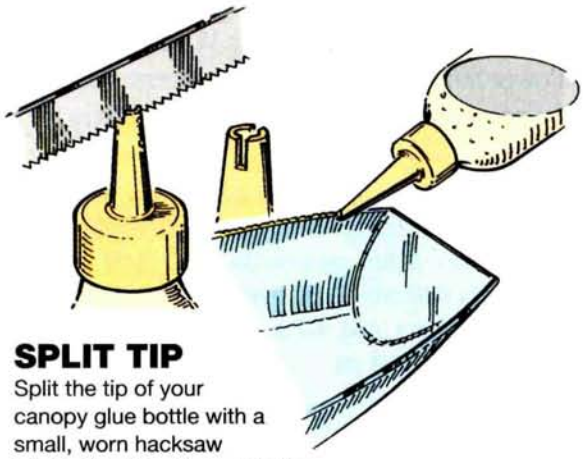
BY JIM NEWMAN

SEND IN YOUR IDEAS. ***Model Airplane News*** **will give a free, one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.**

WARNING TAG

If you use one transmitter for two or more models, you may need to alter its servo-reversing switches. Make this safety-check tag out of plywood or plastic, paint it red with white letters, then glue it to a clothespin (or use a cord and clip). Your columnist recommends the clothespin because it can be clipped to one of the sticks, where it will interfere with your use of the controls (same as in a real plane), and you will be certain to notice it!

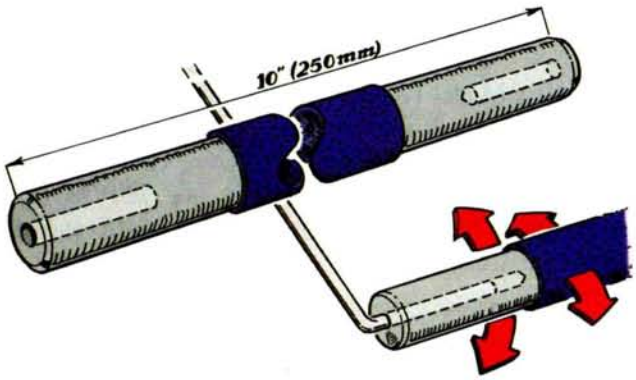
Dave Kovensky, Albuquerque, NM



SPLIT TIP

Split the tip of your canopy glue bottle with a small, worn hacksaw blade. The tip will straddle the edge of the canopy and allow you to accurately apply a fine line of glue to the edge of the plastic.

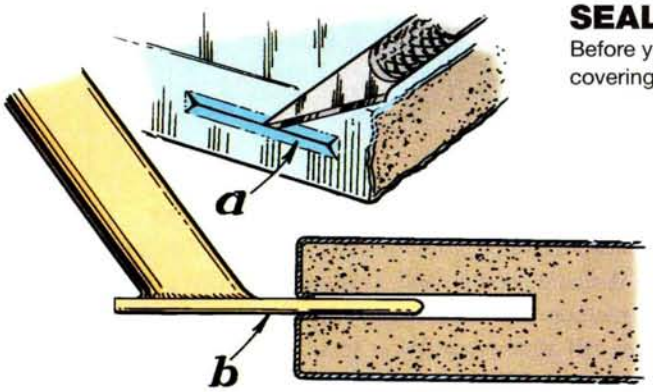
Howard Bernard, Elmwood, IL



GEAR TWEAKER

This gear wire tweaker is made out of any handy metal rod at least 1/2 inch (13mm) in diameter. Drill the ends to fit your usual gear wire diameters and, for comfort, cover it with foam handlebar tape. Slip the tool over the axle, then give the wire a twist, or bend (tweak) to correct the toe-in or camber.

Bill Poté, Hobe Sound, FL



SEALED SLOTS

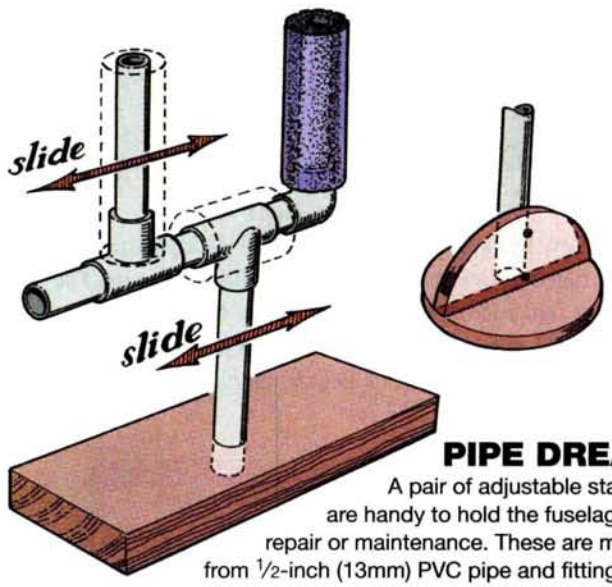
Before you glue in hinges, seal the edges of the hinge slots by forcing the flaps of covering film (a) into the slot with the toe of the trim sealing tool (b).

Blair Lawson, Kingston, Ontario, Canada

BE UPSTANDING

Glue these handy building squares using inexpensive foamboard. The small supporting triangles make them free-standing, and the soft foam allows them to be pinned to the building board, where they will hold fuselage sides upright over the plan.

Jack Arnould, Greenfield, MA



PIPE DREAM

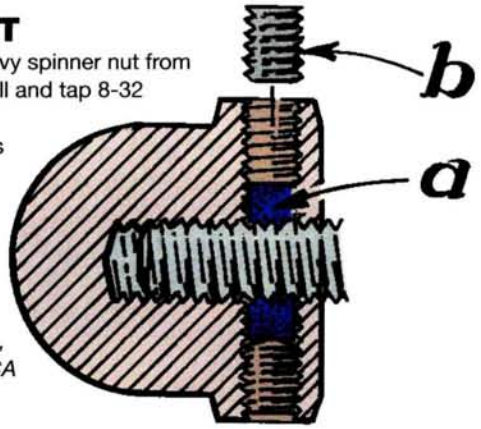
A pair of adjustable stands are handy to hold the fuselage for repair or maintenance. These are made from 1/2-inch (13mm) PVC pipe and fittings and are covered with foam pipe insulation. Leslie uses an 8-inch (100mm) circle of plywood as a base, but you can use any handy scrap of lumber. A pair will cost about five bucks.

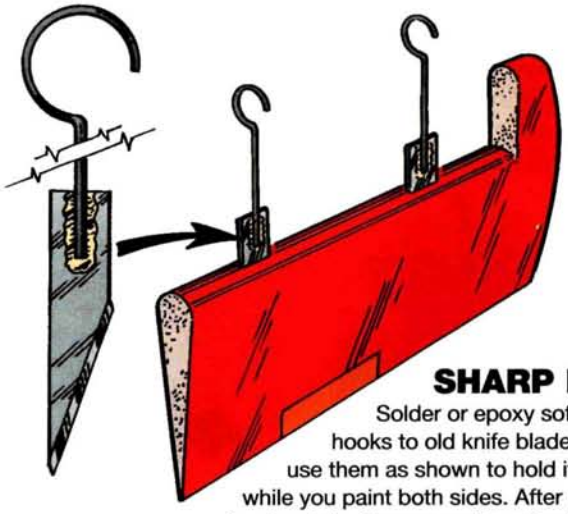
Leslie Bradshaw, Hartsville, SC

LOCK TIGHT

To prevent your heavy spinner nut from becoming loose, drill and tap 8-32 opposite flats, then make press-in plugs (a) out of nylon screws. The plugs protect the shaft threads when you tighten the 8-32 setscrews (b).

Don Hesse, Pacific Palisades, CA

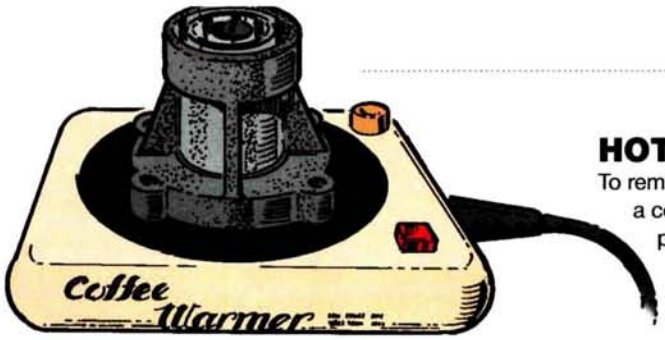




SHARP IDEA

Solder or epoxy soft wire hooks to old knife blades, then use them as shown to hold items while you paint both sides. After painting, hook the items over the raised edges of your shop lights to dry.

Zack Burket II, Graham, TX



HOT TIP

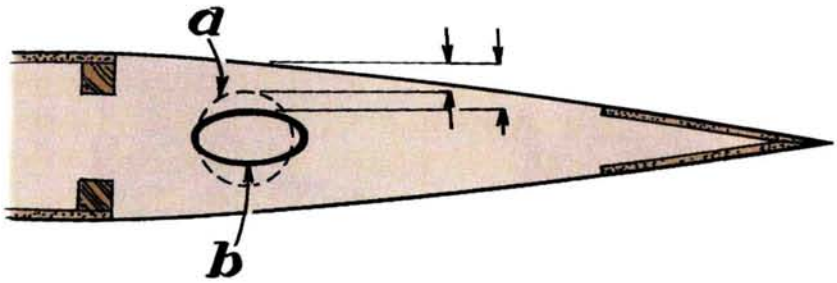
To remove bearings from a crankcase, heat the case on a coffee-cup warmer until the bearing can easily be pulled out. This is much safer than using a propane torch, which can damage the case.

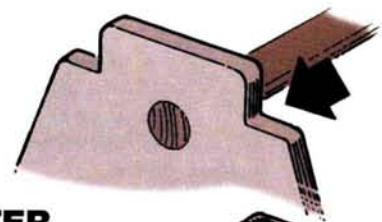
Ernie Armstrong, Napanee, Ontario, Canada

OVAL ENTHUSIAST

Instead of using a round cardboard tube conduit (a) for servo leads, Manuel uses oval heat-shrink tubing (b). Not only is it lighter, but it also allows more wood above and below the leads, so the rib will be stronger.

Manuel Fuentes Rendon, Jalapa, Veracruz, Mexico

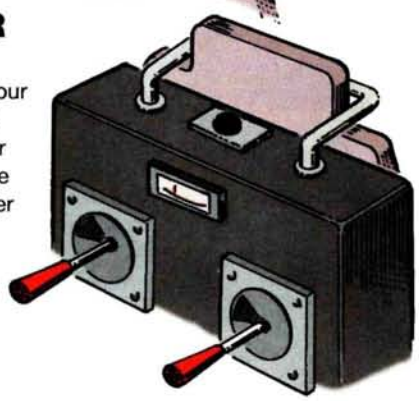




TRANSMITTER TOTE

Notch the shoulders of your flight box so the carrying handle of your transmitter will fit over it. This will free up a hand to carry another essential item.

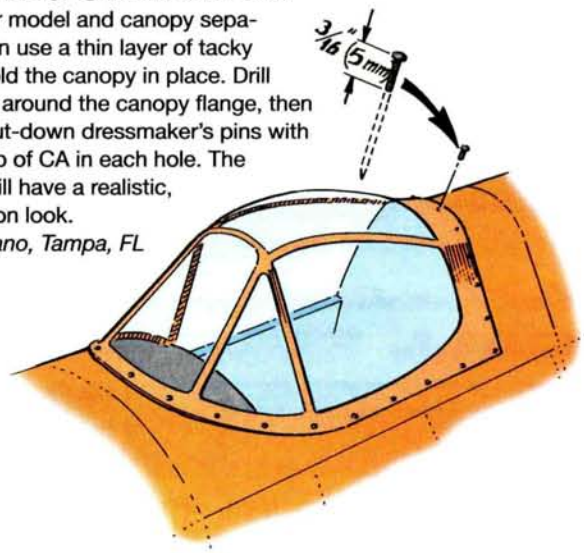
Mike Killion, Mesa, AZ



RIVETING STATEMENT

Paint your model and canopy separately, then use a thin layer of tacky glue to hold the canopy in place. Drill tiny holes around the canopy flange, then push in cut-down dressmaker's pins with a tiny drop of CA in each hole. The canopy will have a realistic, screwed-on look.

Lee Diesiano, Tampa, FL



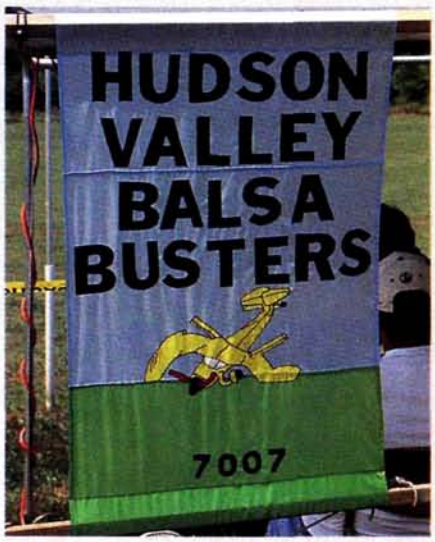
Send in your event coverage. Mail photos, captions and text (500 words or less) to "Grassroots," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Color slides and prints are acceptable.

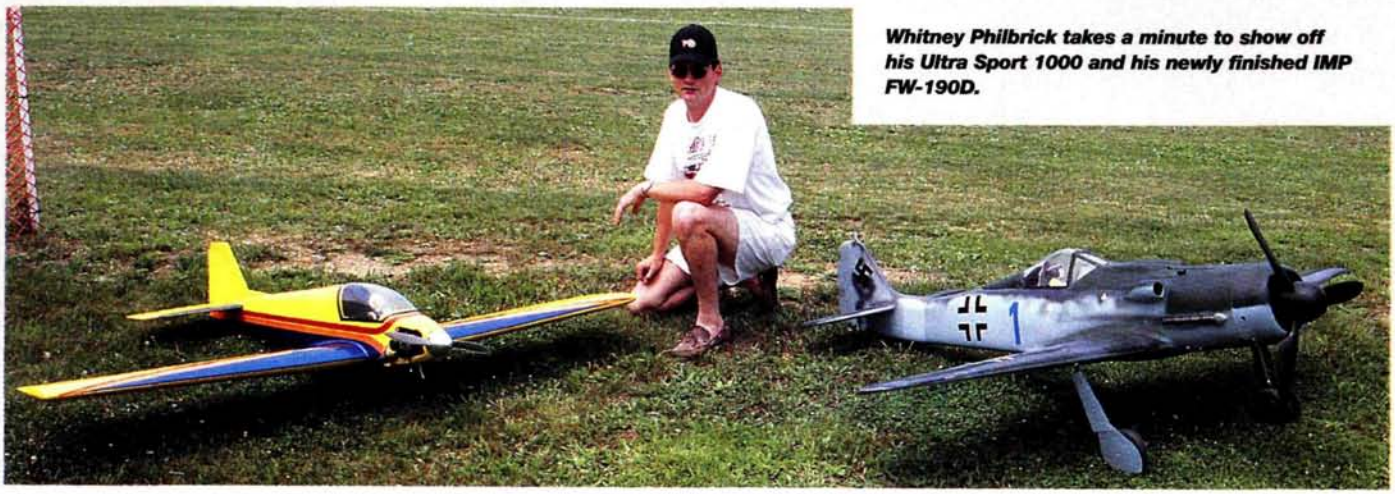
The Hudson Valley Balsa Busters Annual Fun Fly

A few of the models displayed during the Hudson Valley Balsa Busters fun fly.

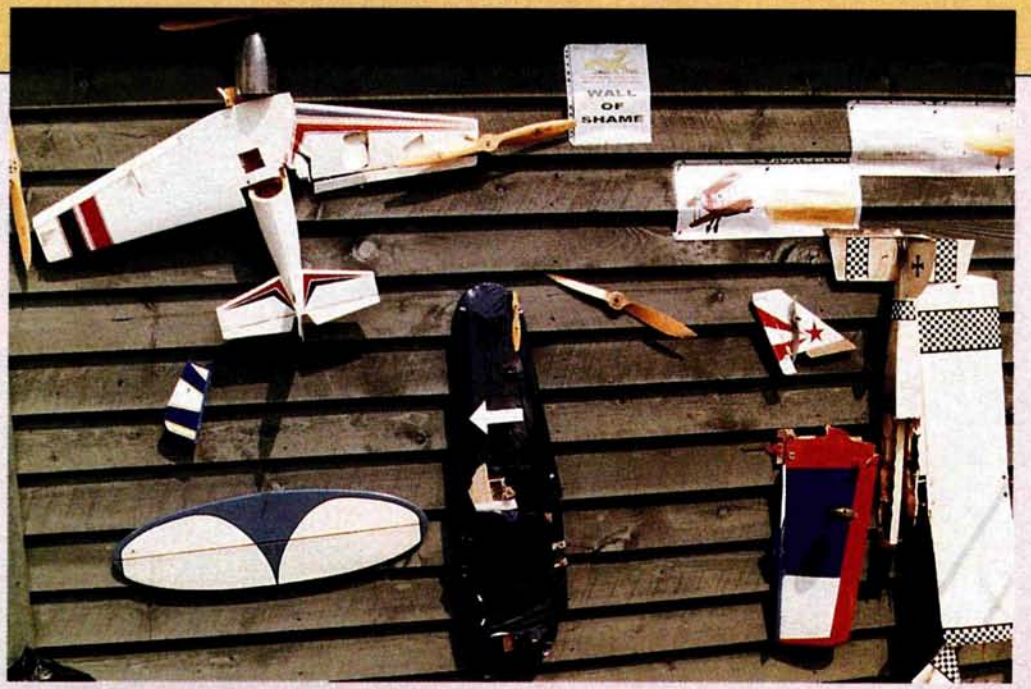
The Hudson Valley Balsa Busters (HVBB) is a relatively new R/C club in the Fishkill, NY, area. Though the club is small—about 20 members—it hosts a fun fly in a big way! Club president and contest director Fred Andros, along with his son Jeff and the rest of the club members, run their annual event with style. The smooth grass runway is an impressive 1,200 feet long and 280 feet wide, and the site is on 75 acres maintained by the club, which has exclusive rights to use the property. The HVBB operates on the "good neighbor" principle and has minor time and fly-zone restrictions to keep the nearby residents happy. It is nice to know that the club and the flying field are viewed by the locals as a good thing for the area.

Nineteen-ninety-eight was the second year in which the club held the fun fly, which is open to all sizes and types of model aircraft. The contest's announcer, Bob Martinson, did a wonderful job of keeping the audience well informed as the 60-plus registered pilots flew their models. Bob also headed the Glider Toss event at the fun fly. Every child under 10 was given a balsa glider and was asked to put it together. Then, during the noontime show, all the kids (about 25) got together for a "Who can throw their glider the farthest?" contest. Each child who participated walked away with a small prize. Their parents seemed to be most impressed—good PR, indeed!

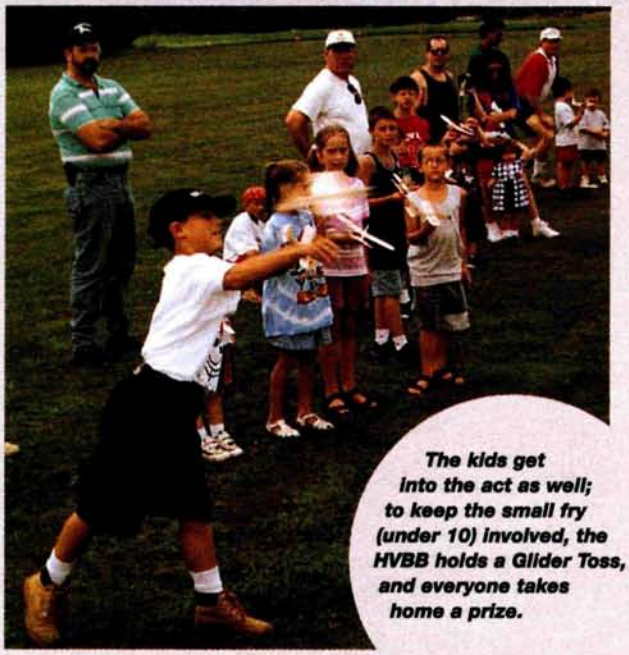




Whitney Philbrick takes a minute to show off his Ultra Sport 1000 and his newly finished IMP FW-190D.



Anyone have some glue? A fitting end to many a lost model, the great "wall of shame" is a repository of bent and broken model parts. It's all in good fun!



The kids get into the act as well; to keep the small fry (under 10) involved, the HVBB holds a Glider Toss, and everyone takes home a prize.

That's the Old Rhinebeck WW I Jamboree bigwig George Buso showing off his vintage pattern ship, the Big One.

Master builder and Top Gun contestant Bill Steffes showed off his 101-inch-span Ziroli-designed AT-6 Texan—impressive flyer.

The rest of the noontime show was filled with flight demos and just about every kind of aircraft you can think of.

Well-known scale modeler Bill Steffes showed off his G-62-powered Ziroli AT-6 Texan and did a great job of buzzing the field. George Buso—the head honcho of the Rhinebeck WW I Jamboree—also stopped by and flew his vintage R/C pattern ship, the Big One. Of special note was Fred's 13-year-old son, Jeff, who very skillfully flew his 10-foot-span Piper J-3 Cub powered by a Quadra 52 gas engine.

From their wonderfully spacious flying field and well-manned food tent to their infamous "wall of shame," the HVBB club has a first-class event on its hands. If you're in the area, try to make this year's event; it promises to be bigger and better than ever.

For more information about the Hudson Valley Balsa Busters and their annual fun fly, contact Fred Andros, 371 Violet Ave., Poughkeepsie, NY 12601.

Easy-to-build, prop-driven SPORT JET

by Rick Bell

FROM THE CORNER of my eye, I saw the MiGs glint in the sunlight. I was in perfect position to surprise them—behind and above, with the sun to my back. I went to full afterburner, pushed the nose down and accelerated to 650 knots. I came in from 200 feet above the ground, homing in on the lead MiG. "Rick, Rick." With the mention of my name, Larry Marshall brought me back to reality because he wanted a shot at flying the new Great Planes* F-4 Phantom II. For a moment, it sure felt as though I was in the cockpit chasing MiGs over Vietnam!

F-4

PHOTOS BY GERRY YARRISH, LARRY MARSHALL & RICK BELL

SPECIFICATIONS

Model: F-4 Phantom II

Type: sport-scale, prop-driven jet

Manufacturer: Great Planes Model Mfg. Co.

Wingspan: 58.5 in.

Length: 64.5 in.

Weight: 11 lb.

Wing area: 844 sq. in.

Engine req'd: .61 to .75 2-stroke

Engine used: O.S. .61FX

Street price: $149

Features: easy-to-build, CAD-engineered kit with molded parts to create the Phantom's complex shapes. Good die-cut wood with "Auto-Lock" construction. Exceptionally detailed, photo-illustrated instruction manual. Internal control linkages. Easy radio access under tail hatch. Complete hardware package. Flaperon option. Neat decal sheet.

Comments: the Phantom II is a great-looking jet that flies well. It's easy to build quickly. The use of molded fuselage parts really helps here. Takeoff rolls are a little on the long side. A paved runway or more power would help, but performance is solid and the Phantom looks the part in the air.

Hits
- Ease of construction.
- Excellent instructions.
- Flaperon option.
- Flight performance.

Misses
- Plastic nacelles were a little too short. *Editor's note: this has been corrected in subsequent kits*

Great Planes Model Mfg. Co.

PHANTOM II

GREAT PLANES F-4 PHANTOM

THE KIT

The Great Planes F-4 Phantom II is a .60-size, semi-scale, propeller-driven jet. This is Great Planes' fifth jet-like model that requires only sport model building and flying skills. This approach allows modelers to build and fly jets without the hassle and expense of using ducted fans. The engine nacelles, inlets, exhaust nozzles and tail cone are molded ABS plastic, and the rest of the model is built using usual methods. The model can be built with flaperons and with fixed or retractable gear. One nice feature is that all of the control linkages are internally concealed. The kit contains very nice die-cut balsa and plywood parts, rolled CAD plans, a clear canopy, landing-gear legs, decals and a photo-illustrated construction manual. The hardware package includes hinges, horns, pushrods, clevises, adjustable engine mount and other needed items. I dressed up the model with Great Planes drop tanks. Note that because of size and balance limitations, Great Planes does not recommend a 4-stroke engine that's equivalent to a .60.

TAIL FEATHERS

For all construction, I used Great Planes thick and thin Pro CA and epoxy. Both the stabilizer and the fin are assembled directly over the plans out of shaped 3/8-inch balsa pieces. The parts fit was excellent. The elevators and the rudder are built in the same way, but using tapered balsa. I tack-glued the control surfaces to their respective surfaces, tapered everything to match the plans, then cut the hinge slots and beveled the elevators and the rudder leading edges (LEs). All other edges were then rounded. I fit the torque rods on the elevator halves and the rudder and fit and glued a lower fin extension to the bottom of the fin.

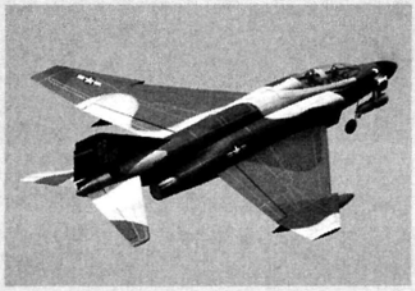
At this point, I jumped ahead in construction to glue the stabilizer halves together. I assembled a jig using the supplied die-cut, lite-ply parts. Make sure the jig is square. Next, I sanded the stab roots halves to the proper angle to create a good joint. The halves were then placed into the jig and epoxied together. Be sure the halves are firmly seated in the jig while the epoxy cures.

WING

Don't let the angles of the wing frighten you. The wing is a D-tube design that's easily built in three sections. I made the sub spars out of various lengths of 1/8x3/8-inch basswood. I decided to install retracts, so I epoxied the appropriate ribs to plywood doublers, being sure to make a set of left and right assemblies. I built the main (center) section first, upside-down on the plans. I pinned the main spars to the plans, and I epoxied them together at the same time with a preshaped center piece, then I epoxied a plywood plate on top of this. I added the ribs, ensuring the jig tabs were contacting the plans. I added another center piece and plywood plate to the center and then added the bottom spars (remember, the wing is upside-down). Sub trailing edges (TEs) are added to the ribs. I made sure everything was square and straight and then glued everything together. Next, I sanded the LEs of the ribs to match the angle on the plans and glued the shaped LEs to the ribs. Next, I added the shear webs to the front of the main spars. The retract mounts and reinforcements were added next, and the retracts were mounted when the epoxy had cured.

The bottom of the wing is now sanded while still pinned to the plans, and the LE,

FLIGHT PERFORMANCE



Because the engine was new, I ran a few tanks of fuel through it first and then proceeded with taxi tests.

• TAKEOFF AND LANDING

Just like its full-scale counterpart, the Phantom uses a lot of runway on its takeoff roll. When flying speed is reached, up-elevator is needed for rotation. Once airborne, backpressure is relaxed to build up speed and to gain some altitude. I made a few trim passes for straight-and-level flight; a little up-trim was all that was needed. Landing the Phantom is easy: set up your approach, start pulling the throttle back, lower the flaps (it also lands well without flaps) and head for the numbers. Once proper attitude is achieved, sink rate is controlled with throttle. Once I was over the end of the runway, I cut power, added up-elevator and let the Phantom settle to a beautiful on-the-mains, nose-high landing. Great fun!

• LOW-SPEED PERFORMANCE

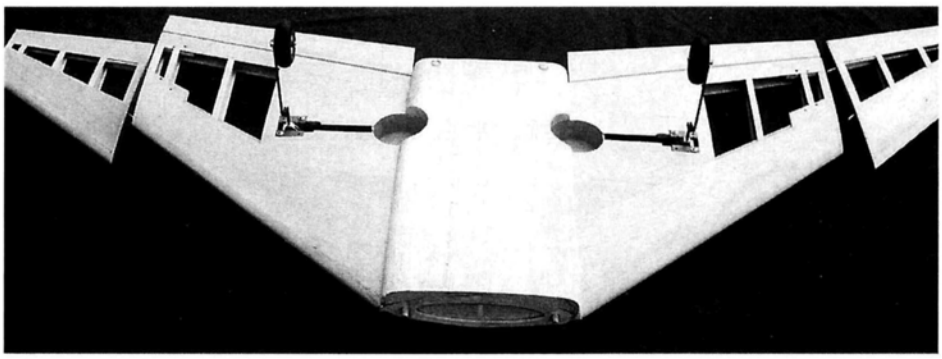
With its big wing and up-swept wingtips, the Phantom handles low speeds well. When it stalls, the break is clean with no surprises. Apply power and the Phantom is flying again. With the flaps deployed, a little down-elevator is needed to keep the nose level. Slow speeds are then even slower. With the ailerons inboard, good control is maintained up to the stall. On my Phantom, a little up-trim was needed to maintain level flight.

• HIGH-SPEED PERFORMANCE

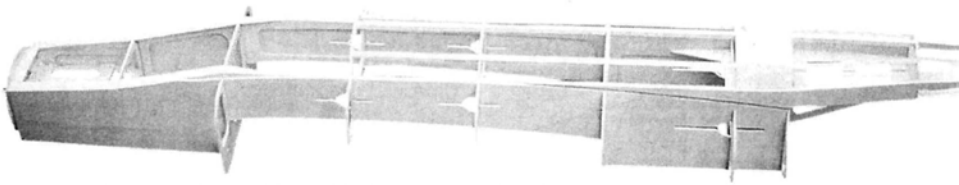
This is where the Phantom shines! It's very solid and tracks as if it were on rails. Set up as per the manual, controls are good. Aileron and elevator are very positive but not sensitive. Wide, sweeping turns are the order of the day, but pull a turn too tight and airspeed will bleed off quickly. No pylon turns here! High-speed, on-the-deck passes with pull-ups to victory rolls sure are fun!

• AEROBATICS

Although the Phantom is capable of loops and rolls, it is not an Extra 300, nor is it claimed to be. Aerobatics are realistic and smooth—perfect for this type of aircraft. Rolls are axial and smooth. Loops could use a little more power, but vertical performance is still surprisingly good. All told, the Phantom is a fun jet to fly.



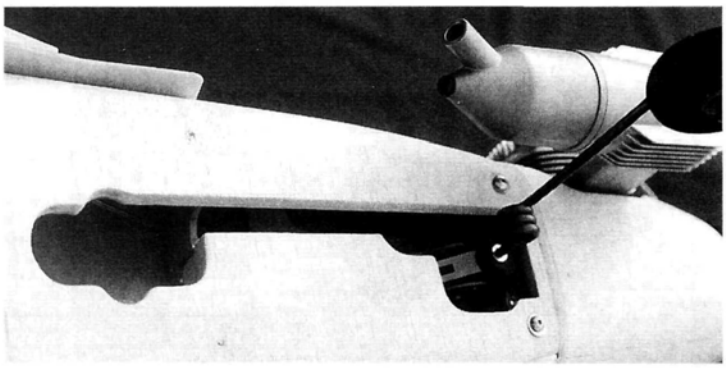
The wing is a D-tube design that's built in three sections.



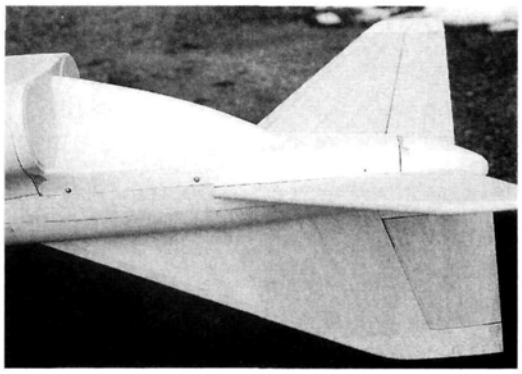
The fuselage uses Great Planes' Auto-Lock construction.

TE and center-section sheeting is added along with the capstrips. Remove the wing when dry. Two crutches are now assembled from die-cut plywood pieces. These support the wing at the tips of the main section when you add the top LE and TE sheeting. Before adding the top sheeting, I made the cutouts for the retracts in the bottom sheeting, added the wheel wells, routed the air lines and made sure the retracts functioned properly. I sanded the top of the wing and tack-glued the crutches to the tips on the bottom of the wing. I replaced the wing on the plans, making sure the crutches and the main spar in the center section were in contact with the building surface. I added the LE, TE and center-section sheeting along with the capstrips.

The main section is now completed by adding the aileron torque rods and plywood tip ribs for the outer panels. I also added the servo tray and final-sanded the wing. The outer panels are built in the same way as the main section and attached after the wing has been covered using plywood braces and dowel pins. The ailerons are also built now and hinged. Because I was using the optional drop tanks, I added plywood mounts and blind nuts where I planned to attach the tanks.



Right: the nose retract is mounted on the firewall, and the hatch that covers the installation is removable. Below: the molded plastic tail cone fits nicely between the tail feathers and really speeds up construction.



FUSELAGE

The fuselage is built using Great Planes' "Auto-Lock" construction. This allows the basic box to be built without glue so that all components can be lined up straight and true before final gluing.

First I made up all the sub-assemblies and the fuselage sides. When you align the front and rear fuse sides on the doublers, leave a small gap for the nacelles to fit into. When you assemble the formers into the fuse sides, be careful when you rotate them into their slots. The firewall and tank floor are now added. Ensure the tank floor is not upside-down, or you will build left thrust. I placed the fuse assembly over the plans to align everything and applied glue where directed. Next, I fitted the engine mount. The plans call for a belly-mounted nose retract; however, the retract I had on hand was made to be mounted on a firewall, so I made the changes necessary for the retract and epoxied the firewall into place. Balsa triangle stock was now added to reinforce the front end. The ends of the fuse sides were pulled together with the radio tray in place and glued together. Be sure to thoroughly wet the fuse sides behind former F7B, or you might crack the sides.

I now added the ¼-inch-square stringers and sheeted the turtle deck. I used the fin assembly as a spacer and added the rear blocks to the fuse. The fin was removed and the blocks carved and sanded to shape. The area behind the firewall on the bottom of the fuselage was sheeted next. Because I used a nose retract mounted on the firewall and planned to mount a steering servo in this area, I made this sheeting a removable hatch for access. I used 1/16-inch birch ply as a base and then sheeted it. Before adding the sheet to the hatch base, I made the cutout for the nose retract using the pattern supplied on the plans.

To start nose construction, you will need to have your engine and spinner on hand. I first mounted the spinner backplate on the engine and then tack-glued the plywood nose ring to the back of the backplate using 1/16-inch ply spacers. The engine is now mounted on the mount with the ply nose ring the correct distance from the firewall. Three balsa blocks are glued between the firewall and the nose ring. I carefully removed the engine and added ½-inch triangle stock to the corners, added the final nose block and then roughly carved and shaped the blocks. Starting in the center of the right side, I made a small hole and gradually enlarged it to accommodate my O.S.* .61FX. I then remounted the engine and attached the spinner to final shape the nose.

The wing is now mounted on the fuse and the belly pan is built. After these have been squared up, the stabilizer is epoxied to the fuse. Because there is not a lot of surface area for the stab-to-fuse joint, I decided to pin the stab to the fuse using dowel pins.

FINAL TOUCHES

Now it's time to fit the nacelles, inlets, exhaust cover (which is the radio hatch) and tail cone. First, the nacelles are trimmed to the molded lines. I ran into a problem here: when trimmed to the lines, the nacelles were ¼ inch too short in the wing saddle and on the aft end. I rechecked the fuselage against the plans and found everything correct. Measuring the nacelles against the plans confirmed the problem. The fix is easy though: just trim the nacelles past the molded lines and then fit them into place. Remember the gaps that were made in the fuse sides? The nacelles fit into these gaps for a positive fit. Once the nacelles had been fit, I attached the inlets. [*Editor's note: this has been corrected in subsequent kits.*]

I assembled the radio hatch halves and added the front plate. Then I fitted the hatch to the fuse and added blocks for the retaining screws. I now fitted the tail cone and glued it into place. I also fitted the canopy and added Williams Bros.* pilots.

The airframe is now ready for final sanding. The instructions call for gluing the nacelles to the fuse after they have been painted and the fuse has been covered. This would require filling the joint and touch-up painting of the nacelles and fuse. Instead, I glued the nacelles to the fuse before covering using Zap-A-Dap-A-Goo, then I filled the joints. The plastic parts quickly give you a finished fuselage with a minimum of work.

Next, I covered the Phantom with Polytex* and painted it using a combination of LustreKote* dove gray, tan, olive drab and aluminum paints. I also used Testor's dark green paint, since LustreKote is not available in dark green. Next, I added panel lines and decals and sealed everything with a coat of Lustrekote flat clear.

The radio gear, pushrods, retracts, engine and fuel system were now installed and final operation checks made. I balanced the model and set up the control throws as recommended. The Phantom was now ready for its first flight.

SUMMARY

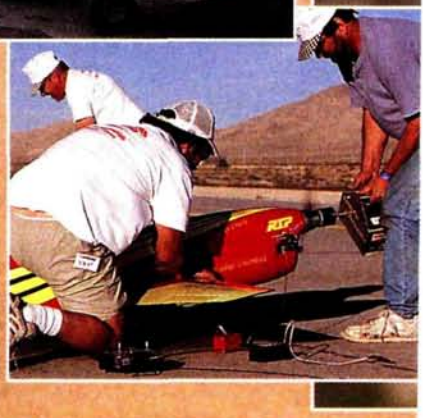
Did Great Planes come through with a simple jet? I think so! Although it's not a beginners' model, it's easy to build and looks great. The use of ABS molded plastic for the complex shaped parts really cuts down on the building time. The model flies well and looks great in the air, especially with the gear up and the drop tanks attached. If you're looking for a neat-looking jet that's easy to build, the Great Planes F-4 Phantom II is hard to beat.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ✦

USRA

UNLIMITED SCALE RACING ASSOCIATION

World C



Top (left to right): the Area 51 team readies Mel Santmeyer's Sport Mong biplane for action; Bad Moon Racing airplanes are easily identified by their outstanding paint schemes. Here, team members make Mike Adams' Formula One model shine; Team Aerosport member Brian White checks the engine in Fred Sattler's trophy-race-winning AT-6. Bottom (left to right): Jerry Bradley's scratch-built Caudron awaits the takeoff signal; the Middle Age Racing team fires up Hippy Cirelli's scratch-built Caudron.

by Debra Sharp

Last fall, just outside Las Vegas in Jean, NV, 88 R/C pilots from 32 teams hoped to win big at the Unlimited Scale Racing Association (USRA) World Championship Air Race.

Life in the Fast Lane

Airplane pylon racing has been a gamble since the 1920s, when pilots of full-size airplanes climbed into their cockpits at the first National Air Races, and racing giant-scale models today is no different. No matter how sweetly the engine purrs in the pit area or how quickly the plane turns the pylons in practice, all bets are off when the clock counts down. The competition is close, and one miscalculation on the sticks can mean the difference between winning the heat and crossing the finish line a few seconds later with second, or even third, place.

hampionships

PHOTOS BY DEBRA SHARP

Main image: Cal Orr's Byron Gilmore on a flyby. As well as competing in the Thompson Trophy class, Cal was one of the flightline directors. Above: John Creagh of Bad Moon Racing won the world championship title and the Jean Trophy race with this KT Aviation Mong powered by a Zenoah 445 engine.

Mark Chapman of MC² Racing pilots his Formula One RacePro GR-7 around a pylon. Mark and his team traveled all the way from Florida.

JEAN FACTS

KITS

RacePro	34
Scratch-built	9
KT Aviation	5
Team Extra	4
AeroSport	2
BS Racing	2
Byron	2
Bridi	1
GT Racing	1
Horn Dog	1
R&S Racing	1
Saxton	1

ENGINES

Zenoah*	36
A³	13
Aerrow	10
Herbrandson	5
Husky	5
3W-7	23
J44	2
Moki 3.6	1
Sephar	1
Twin Aero	1

*Required in all 24 Texans

PLANES

Biplane

Mong	5
Pitts	2
Knight Twister	1

Experimental

Lancair IV	7
Super Caudron	1

Formula One

GR-7	11
Kelly F1-D	3
Polecat	3
Nemesis	1

Thompson Trophy

Caudron	4
Gee Bee	1
Gilmore	1
Hughes H-1	1
Laird Turner	1

Unlimited

Tsunami	7
Bearcat	2
Miss Ashley	1
NA-50	1
Sea Fury	1
Stiletto	1
Super Corsair	1
Vendetta	1

Ken Hansen's Team JR AT-6 model.

At the start of the races, everyone knew that some pilots would leave Jean with world championship titles, more would win cash and other prizes and an unlucky few would take home models that needed repairs. Only one thing was certain: the racers, pit crew and their families had all come to Jean looking for action, exhilaration and a good time, and no one would go home disappointed.

Race promoter Archie Snider and his staff made a sure bet when they chose this event site. With the Gold Strike Hotel and Gambling Hall just across the road from Jean Airport, the evening activities were almost as exciting as the rivalries on the flightline (if you don't beat 'em around the pylons, you may beat 'em at the blackjack table!). The hotel also hosted a banquet for 200 racing fans to celebrate the successful conclusion of another giant-scale racing season. As USRA president Ron Eisner noted, "The racing just keeps getting better and better. Some veterans are

The Bipe to Beat in '99?

The engineers and builders who support giant-scale racing never rest, and Joe Marine of RacePro* proved that by offering a sneak peek at the plug of his newest USRA-legal design, "Sundancer." If its performance is true to that of the original Sundancer, this 33-percent-scale, molded-fiberglass-composite gull-wing bipe may blow the competition away in 1999.

In the mid-1970s, the full-size Sundancer was so much faster than "sport" biplanes—even faster than many Formula One planes—that it was ruled illegal.

Joe says, "The model tracks very straight and true yet turns on a dime. With a modified Z445 on glow, it reaches speeds of well over 150mph."

Specifications: wingspans—80/51 inches; chords—13.25/9 inches; length—64 inches; engine—3.7 to 6ci; flying weight—18 to 20 pounds.

coming back, and some new faces are starting to show up. We seem to be going in the right direction; 1999 is going to be a very exciting year!"

THE AIRPLANES

There are six classes in USRA racing: Experimental, Unlimited, AT-6, Formula One, Thompson Trophy and Biplane. All models must be scale representations of full-size aircraft that are qualified to compete at Reno or in other Unlimited races. Each class has its own specifications and weight and engine limitations. In the 1998 season, the Unlimited Warbird class was renamed, "Unlimited," and the Formula One class standardized its engine size at 4.6ci (in 1997, Formula One racers were divided into 4.6 and 6ci engine classes).

The popular AT-6 class, in which the models are powered by stock Zenoah G-62s and use identical propellers and fuel, attracts the largest field of competitors

Top: Thompson Trophy racers like Ray Thompson's scratch-built Caudron add a touch of nostalgia to giant-scale competition. Center (left to right): Mike Adams placed fifth in the Jean Trophy race with his Miss Ashley Unlimited racer; Tom Easterday, a founder of Unlimited giant-scale racing, bleeds some speed off his Kelley F1-D after a Formula One heat race. Above (left to right): Hobby Club team members prepare Cal Orr's Gee Bee for flight; StaBrite team member Scott Manning set a new giant-scale-racing world record with his Horndog Super Corsair powered by a Herbrandson engine.

1998 WORLD CHAMPIONS

BIPLANE
John Creagh, Bad Moon Racing

THOMPSON TROPHY
Roger Cirelli, Middle Age Crazy

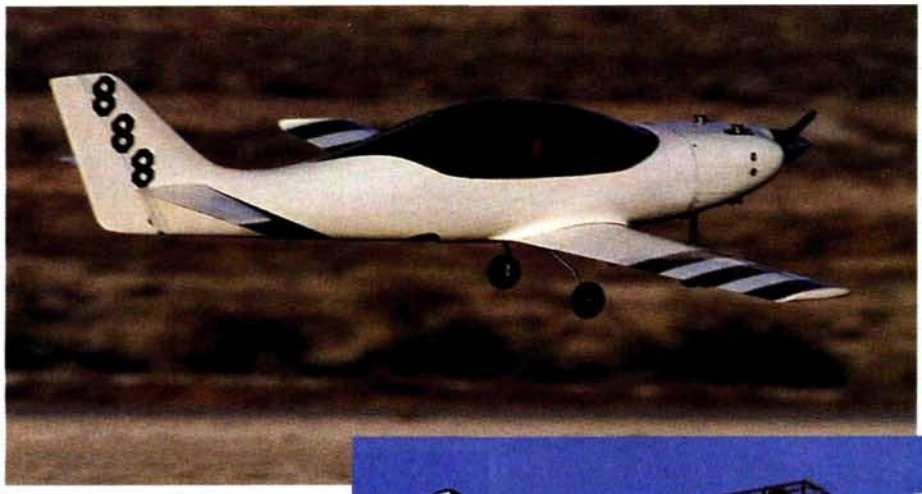
AT-6
Shawn Everson, Team AeroSport

FORMULA ONE
Scott Manning, BS Racing

EXPERIMENTAL
Archie Snider, Team Aerosport

UNLIMITED
Archie Snider, Team AeroSport

These racers accumulated the most points in two out of the the three 1998 World Championship Series of Air Racing (WCAR) events and won a spot to compete in the 1999 Air Race of Champions (AROC) series. In these races, each pilot will fly specially designed and identically built and prepared RacePro AT-6 models equipped with an Airtronics Stylus radio, Husky Challenger 4.4ci engine, Gene Barton retracts and AeroSport data logger and camera to record the action. The racer who has the most points at the end of the series will keep an AROC plane valued at $6,500 and additional cash and prizes.



Left: Bill Cunningham of A³ Racing won the Experimental Trophy Race and $1,000 with his RacePro Lancair IV. Below: Blues Brothers team member and USRA president Ron Eisner piloted his RacePro Texan to first place in the Bronze AT-6 Trophy Race.

and is truly a test of pilot skill. At the other end of the spectrum, the Unlimited and Experimental classes are as much a battle of engine and airframe as they are of quick reflexes and racer savvy. The maximum aircraft and engine weights are the same for the Experimental and Unlimited classes, but warbird racers compete in Unlimited, and the Experimental class is dominated by Lancairs. In the Unlimited Trophy race, Scott Manning set a new giant-scale racing world record of 77.76 seconds with his Horndog Super Corsair powered by a Herbrandson engine.

R/C'ers who insist that their airplanes have two wings make up the Biplane class, and all five Trophy Race qualifiers at Jean raced KT Aviation Mong models. The Thompson Trophy racers provide a taste of the Golden Age of airplane racing and some of the more uncommon aircraft subjects. In one race, Cal Orr's Byron Gee Bee captivated the crowd and then landed in true Gee Bee style.

GO FAST, TURN LEFT

The course consists of two pylons that are ¾ mile apart, and the start/finish line is in the middle. The planes race around the pylons counterclockwise for a total of six laps, and turn judges stationed at each end of the course switch colored lights on in the pylon to let pilots know they passed it.

TROPHY RACE WINNERS

Pos.	Award	Pilot/tail no.	Team	Cuts	Adj. time	Plane	Kit	Engine	Radio
BIPLANE									
1	$500	John Creagh/39	Bad Moon Racing	1	117.57	Mong	KT Aviation	Zenoah 445	JR
2	$300	Tom Keating/44	PMB Racing Team	1	121.11	Mong	KT Aviation	Zenoah 445	JR
3	$200	Gary Hyde/36	Bad Moon Racing	1	121.39	Mong	KT Aviation .	Zenoah 4. 45	JR
4		Kent Mc Kenna/88	Laid Back Racing	2	128.54	Mong	KT Aviation	Aerrow 75 RSS	Futaba
5		Mel Santmyers/24	Area 51	-	143.69	Mong	KT Aviation	Spehar	Hitec
THOMPSON TROPHY									
1	$500	Roger Cirelli/69	Middle Age Crazy	-	115.14	Caudron C-460	Scratch-built	Husky 4.4	JR
2	$300	Tom Keating/H-1	PMB Racing Team	-	122.69	Hughes Racer	Scratch-built	Zenoah 445	JR
3	$200	Joe Casey/29	Oblivion	-	132.20	Laird Turner	Scratch-built	Quadra 75	Futaba
4		Tennis Cornum/99	Middle Age Crazy	1	134.58	Caudron C-460	Scratch-built	Husky 4.4	Futaba
5		Cal Orr/777	Hobby Club USA	-	141.87	Gilmore/Gee Bee	Byron	Brison 4.8	JR
AT-6–GOLD									
1		Fred Sattler/1	Team AeroSport	1	126.68	AT-6	AeroSport	Zenoah G-62	JR
2		Shawn Everson/7	Team AeroSport	-	131.15	AT-6	AeroSport	Zenoah G-62	Futaba
3		Tom Saldivar/8	Bandit Racing	1	132.71	AT-6	RacePro	Zenoah G-62	JR
4		Jack Thomas/91	Bandit Racing	-	135.73	AT-6	RacePro	Zenoah G-62	JR
5		Fred Burgdorf/75	Solo pilot	2	140.01	AT-6	Mod. RacePro	Zenoah G-62	Futaba
AT-6–SILVER									
1		Jack Thomas/91	Bandit Racing	-	130.95	AT-6	RacePro	Zenoah G-62	JR
2		Denny Baker/690	DB Racing	-	132.24	AT-6	RacePro	Zenoah G-62	Futaba
3		Sam Stephens/443	TEAMAUI	1	137.33	AT-6	RacePro	Zenoah G-62	JR
4		Dennis Galloway/3D	-	1	140.16	AT-6	Byron	Zenoah G-62	-
5		Bob Thomas/6	Bandit Racing	-	147.42	AT-6	Saxton	Zenoah G-62	Futaba
AT-6–BRONZE									
1		Ron Eisner/3.14	Blues Brothers	-	133.50	AT-6	RacePro	Zenoah G-62	Airtronics
2		Jack Thomas/91	Bandit Racing	-	133.75	AT-6	RacePro	Zenoah G-62	JR
3		Alain Trapier/133	MAC's Products	-	149.05	AT-6	RacePro	Zenoah G-62	Airtronics
4		Bill Fullmer/19	Solo pilot	-	151.70	AT-6	RacePro	Zenoah G-62	JR
5		Tom Rullman/657	GT Racing	3	0.00	AT-6	GT Racing	Zenoah G-62	JR

Each heat sees four or five models race, and all were extremely well-organized and executed. After the planes have been staged on the runway, the teams have 2 minutes to start the models' engines and get them into the air. Nothing comes close to the roar of five, giant-scale powerplants; even if you aren't a pilot, that sound is sure to get your adrenaline pumping. The planes take off one at a time and circle for 1 minute as the clock counts down to the start, when each pilot wants his plane to be the first to cross the start line. During the race, each pilot is assisted by a turn caller who stands behind him and lets him know when to turn. The airplanes race for less than 3 minutes and incur time penalties for jumping the start and cutting pylons. To win a race, everyone on the team must work together as smoothly as the parts of ... well ... a well-tuned engine.

In the heat races, every winner earned some cash, thanks to a $1,000 purse from Airtronics. An additional $10,000 was divided among the Trophy Race winners, and Rookie of the Year, Gary Hyde, who competes in the Biplane class, took home $500.

AIR RACE OF CHAMPIONS

During the 1999 racing season, the 1998 world championship pilots will compete in three heats at each of the three USRA-sanctioned races to determine the overall world champion, who will win more than $10,000 in cash and prizes. Because the pilots will race identically prepared AT-6 models, the Air Race of Champions series will be an exciting test of nerve and talent.

The 1999 USRA World Championship Air Race Series, including the AROC series, will be held on June 3 through June 6 in Rialto, CA, at Oshkosh, WI, from August 4 through 7 and at Jean, NV, from October 20 through 24. If you'd like to attend or to learn more about giant-scale racing, check out the USRA website at www.usra-racers.org, or contact USRA, P.O. Box 819, Brea, CA 92822; (714) 256-7822.

WCAR series promoter Archie Snider placed second in the Experimental Trophy Race with his RacePro Lancair.

TROPHY RACE WINNERS

Pos.	Award	Pilot/tail no.	Team	Cuts	Adj. time	Plane	Kit	Engine	Radio
FORMULA ONE–GOLD									
1	$700	Ken Thornton/3.14	Blues Brothers	-	No time	Polecat	RacePro	Zenoah 445	Airtronics
2	$500	Scott Manning/41	BS Racing	-	No time	Polecat	BS Racing	Zenoah 445	Futaba
3	$350	Bill Malo/3	BS Racing	-	No time	Polecat	BS Racing	Zenoah 445	Futaba
4	$250	Fred French/17	Check 6	-	No time	GR-7	RacePro	Aerrow 75	Futaba
5	$200	John Creagh/39	Bad Moon Racing	2	No time	GR-7	RacePro	Zenoah 445	JR
FORMULA ONE–SILVER									
1		Ken Mc Spadden/19	Bad Moon Racing	1	109.60	GR-7	RacePro	Zenoah 445	JR
2		Ben Mc Bride/61F	McBride's Racing	1	110.79	GR-7	Race Pro	A^3 4.4	JR
3		Mike Adams/16	Bad Moon Racing	2	117.52	GR-7	RacePro	Zenoah 445	JR
4		Charlie Powell/9	Check 6	0	118.75	Polecat	DW	Aerrow 75	Futaba
5		Mark Chapman/445	MC^2 Racing	Deadline	-	GR-7	RacePro	Zenoah 445	JR
UNLIMITED–GOLD									
1	$700	Scott Manning/222	StaBrite	-	77.76***	Super Corsair	Horndog	Herbrandson	Futaba
2	$500	Archie Snider/91	Team AeroSport	-	77.86	NA-50	AeroSport	A^3 8.8	JR
3	$350	Jeff Powell/12	Check 6	1	96.70	Tsunami	RacePro	Herbrandson 200	JR
4	$250	Bruce Brown/15	Brown Boys	-	102.10	Vendetta	Bridi	A^3 8.8	Futaba
5	$200	Mike Adams/38	Bad Moon Racing	-	115.60	Miss Ashley	RacePro	Aerrow 200	JR
UNLIMITED–SILVER									
1		Bill Cunningham/888	A^3	-	104.00	Stiletto	-	A^3 11.4	Futaba
2		Chuck Winter/60	Merced R/C Flyers	-	110.64	Tsunami	RacePro	A^3	Futaba
3		Tony Plebenek/09	Johnson Ford	-	124.68	-	-	Herbrandson	-
4		Ken Thornton/3.14	Blues Brothers	-	DNS	Tsunami	RacePro	Aerrow 200	Airtronics
5		Loren Tregallas/25	—	-	DNS	Sea Fury	DW	Aerrow 200	JR
5		Gene Barton/610	Black Bart Racing	-	DNS	Tsunami	RacePro	Aerrow 200	Futaba
EXPERIMENTAL									
1	$1,000	Bill Cunningham/888	A^3 Racing	-	80.32	Lancair IV	RacePro	A^3 11.4	Futaba
2	$600	Archie Snider/1	Team Aerosport	-	80.63	Lancair IV	RacePro	A^3 8.8	JR
3	$400	Fred Sattler/4	Team Aerosport	-	83.24	Lancair IV	RacePro	A^3 8.8	JR
4		Daniel Goldberg/160	Goldberg Racing	-	90.47	Lancair IV	RacePro	Aerrow 200	Futaba
5		Jeff Powell/12	Check 6	-	99.74	Caudron C-460	Scratch-built	Aerrow 200	Futaba

KYOSHO T-33A Shooting Star

by John Kauk

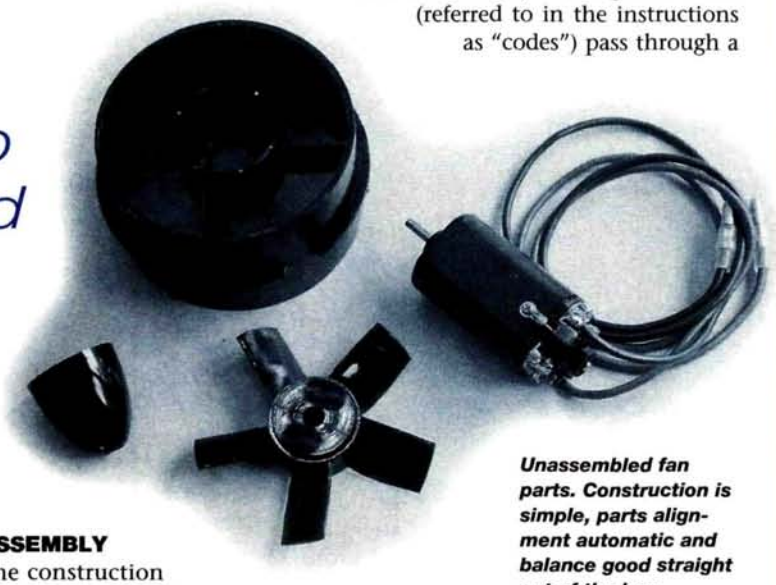
THE LOCKHEED T-33A was the first jet-powered trainer to be used by the U.S. Air Force. The design was based on a lengthened F-80C Shooting Star fighter, and it proved to be more successful in its trainer role than it was as a fighter. Operational in 1949, the last T-33 was retired from service in 1988.

The Kyosho T-33 is a molded-foam, stand-off-scale, quick-building model designed to fly on electric power. It arrives in an attractively decorated box with several color photos of the completed model. The tightly packed contents are well protected from shipping damage. The large foam parts are all neatly wrapped in plastic bags, and the smaller parts, including the motor and fan assembly, are packed in a box to keep them in place. There is also a huge sheet of decals for decorating the model in the Air Force Thunderbirds' color scheme.

The construction sequence is detailed in an illustrated manual with instructions in both Japanese and English. The English translation is lacking in some areas, but careful attention to the drawings and symbols for each step will make things more clear.

Since the plane is made of molded foam, plastic and plywood, I used a combination of Zap* Z-Poxy 5-minute and Bob Smith* 15-minute epoxies for assembly.

Easy way to ducted fans



Unassembled fan parts. Construction is simple, parts alignment automatic and balance good straight out of the box.

FAN ASSEMBLY

The first step in the construction is to assemble the fan unit. All of the parts fit well, and the assembly is about as simple as it gets. I replaced the supplied connectors with Anderson* Power Poles to match the rest of my equipment. I couldn't resist running mine when I got to this point, and it was smooth and vibration free. Just be careful to keep your fingers clear of the blades if you try this yourself.

WING ASSEMBLY

The wing is a one-piece, molded-foam core with a shiny, durable plastic skin. The ailerons, hinges and torque rods are molded in, so there's no construction to speak of in the traditional sense. Following the instructions, I epoxied the aileron servo plate into the recess in the center of the wing. When the epoxy had cured, I installed the servo and aileron linkages, cut the ailerons free with a hobby knife and adjusted the aileron throws to the recommended 5mm movements. Next, I installed the wing-bolt plates in the bottom of the wing, and at this point, the wing assembly was complete.

FUSELAGE CONSTRUCTION

The fuselage consists of top and bottom molded-foam halves. The first step is to install the wing attachment plate in the fuselage bottom. Pay attention here; I managed to put it in upside-down when I did it. The mistake was easily corrected, but save yourself the bother by doing it right the first time. Knowing my propensity to lose bolts and other small parts at the field, I replaced the metric blind nuts with 6-32 nuts, just in case. Next, I trimmed and installed the vacuum-formed plastic nose skid cover and installed the forward wing attachment plate.

Fan installation is the next step. The fan assembly fits into grooves molded in both fuselage halves and is held in place with double-sided tape. The power wires (referred to in the instructions as "codes") pass through a groove in the fan shroud, then through a hole under the wing attachment plate that passes though to the wing-saddle area. The hole in my fuselage was covered by molding flash, so I missed it when I installed my fan and didn't catch it until it was too late to fix. Before proceeding to the next step, I checked the fit and alignment of the wing and made sure the aileron torque rods didn't bind on the wing attachment plate in the fuselage bottom.

After installing the elevator pushrod in a groove molded into the fuselage top half, I epoxied the two fuselage halves together. I used 15-minute epoxy but wish I had had more time to align the sides. I recommend using 30-minute epoxy for this step. I used masking tape to hold the two halves in alignment while the glue cured completely.

EMPENNAGE

The stabilizer and fin are made of the same plastic material as the wing, and the hinges are also molded in. Assembly consists of cutting the elevator out around the hinges using the dimensions given in the instruction manual and then installing the control horn. The areas to be glued should be sanded or slightly abraded with steel wool to give the epoxy a better grip. Since I planned to paint mine, I rubbed the entire surface of the wing, fin and stab with 0000 steel wool. Then I glued the fin to the stabilizer, making sure it was square, and glued the tail feathers on the fuselage with 15-minute epoxy, again checking alignment before the glue cured. Finishing up the assembly, I glued a small plywood plate into the cockpit area for the elevator

SPECIFICATIONS

Model: Kyosho T-33A Shooting Star

Type: stand-off-scale electric ducted fan

Manufacturer: Kyosho

Wing area: 302 sq. in. (19.5dm^2)

Wingspan: 46 in. (1,170mm)

Length: 35 in. (890mm)

Weight: 42 oz. (1,200g)

Wing loading: 20 oz. /sq. ft. (61.5g/dm^2)

Power used: AP 29L motor and Kyosho fan, Lofty Pursuits LPSC-1 speed control, 7-cell Sanyo 1700 SCRC battery

Radio requ'd: 3 channels (motor, aileron, elevator)

Radio used: Futaba* 8UAF, FMA Direct Micro 2000 receiver, Futaba S-3101 microservos

Street price: $149.99

Features: molded foam and plastic construction; motor and fan included in kit.

Comments: the Kyosho T-33 is an excellent entry into EDF flying. Fast building and good design and flying qualities combined with its reasonable cost make it a truly good value.

Hits
- Fast, easy assembly.
- Excellent decal set.
- Supplied power system flies the plane quite well.

Misses
- English translation of the instructions could be improved.

FLIGHT PERFORMANCE

The first flights were at the Buc Le field in Quakertown, PA, the day before KRC. After checking the CG one last time, I checked the control surfaces for movement in the proper directions and checked to see that the fan blew air out the right way. That done, there were no more excuses. Time to fly.

• TAKEOFF AND LANDING

Jim Ryan was handy, so I asked him to help by launching the plane for me. Having never flown a hand-launched jet model before this, I was concerned about initial loss of altitude. I shouldn't have been. After a short run, Jim gave it a firm toss toward the horizon, and the T-33 simply flew away without losing any altitude at all and climbed out briskly.

Landings are simple, since the plane glides well. I just reduce throttle after lining the plane up with the runway and keep the wings level. Flaring about a foot off the ground allows the plane to slow, and it will drop right in.

• HIGH-SPEED PERFORMANCE

At high speed, the T-33 flies very smoothly and tracks really well. Full throttle all the time would cut into flight duration and really doesn't add a lot of speed over the ¾ throttle setting, so that's where I tend to fly it. As with all planes, good power management results in longer flights.

• LOW-SPEED PERFORMANCE

The T-33 will fly fairly slowly but with a nose-up attitude that looks kind of funny in a jet. The ailerons remain responsive right down to stall speed, so control is fairly positive. Stalls are uneventful: the nose drops straight ahead and the plane resumes its flight as it regains speed. One thing to remember when flying this plane low and slow is that you can't get out of trouble with power application as you can with a prop plane. You have to fly it on the wing, and that means keeping the speed up.

• AEROBATICS

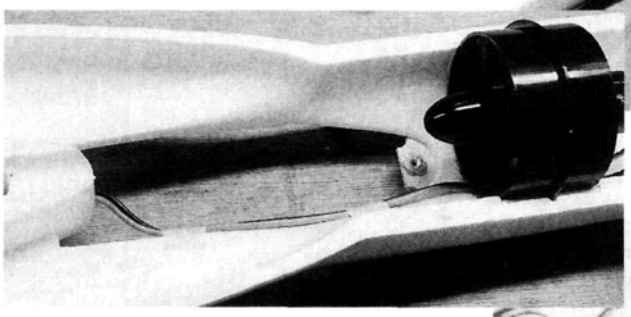
All aileron/elevator maneuvers are possible with this plane. With the recommended aileron throws, I thought the roll rate was a little slow, so I increased them to 8mm both ways. With the stock power setup, good loops require a slight diving entry. My favorite maneuver is a fast, low pass down the runway followed by a climbing, rolling pull-out.

servo and glued in the canopy attachment blocks. After attaching the control rod to the servo horn and fastening the servo in place, I adjusted the elevator throws to the specified 5mm travel.

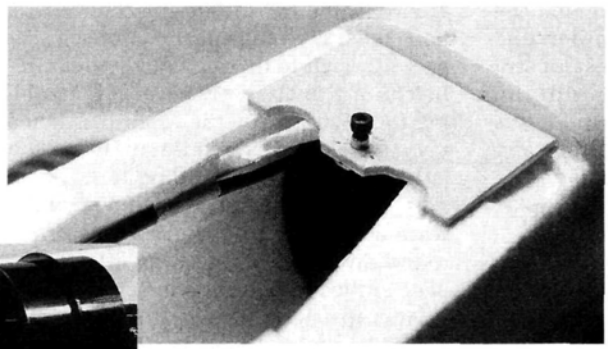
FINISHING

At this point, I broke from the sequence in the instruction manual to paint the model. Since I hope to fly the plane with other T-33s that my friends are building, I figured I should use something other than the stock Thunderbird scheme the kit decals are designed for. I used Poly Scale* and Testor's* Model Master Acryl paints, figuring that, since they clean up and thin with water, they're safe to use on the foam. I chose a simple color scheme similar to that used by the 94th Fighter squadron in Alaska in 1947—bare aluminum and high-visibility orange. The paints worked wonderfully, and I'm pleased with the look of the model.

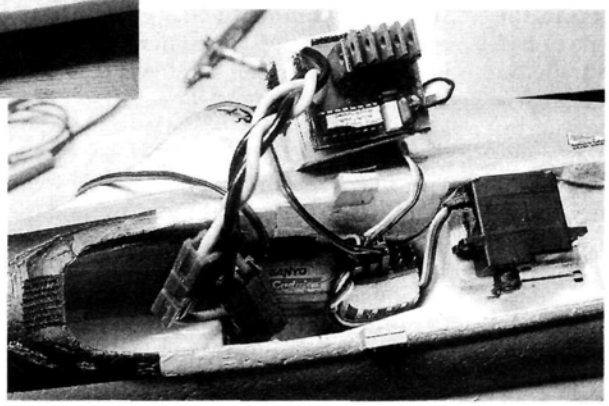
After painting and applying the decals, I trimmed and fitted the canopy. It's held in place with Velcro®-brand fastener, which is surprisingly adequate. The receiver, speed control and motor battery all fit into a compartment under the canopy. Since I don't have a BEC speed control that can handle the 30 amps this plane requires, I used a 270mAh battery and a Lofty Pursuits LPSC-1 speed control. This controller is no longer available, but the new Astro* 215D is great replacement and will save a little weight and space. To fit everything in the compartment and still allow room for the battery pack, I built a small platform out of balsa scraps to get the ESC and RX switch up and out of the way. I used a Great Planes* CG Machine to check the balance, and attained proper balance by moving the motor battery to the aft end of its compartment.



Fan installation in the lower fuselage half. Sharp duct corners and inlet lips should be rounded for smooth airflow.



Here's the wire routing mistake I made. Notice the groove under the wing attachment plate where the power wires should run.



Elevator servo location and radio/battery compartment. Space is a little tight; notice the ESC platform to make more room below. A BEC controller like the AstroFlight 215D would make this installation simpler.

SUMMARY

The Kyosho T-33 is a well-designed entry into electric ducted-fan flying. It "builds fast"—it took me about eight hours to get the plane ready to fly—and it's fun to fly. I ended up increasing the aileron throws to about 50 percent more than recommended in the instructions, but the elevator throws were fine as listed. If you're at all interested in flying jet models, this is an excellent place to start.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

If you're looking for a big, aerobatic airplane that won't cost you an arm and a leg, then the Lanier RC* CAP 232 might be for you. It's an easy building kit that looks great, is a great flier and has good low-speed stability. I thoroughly enjoyed building and flying this airplane and highly recommend it for advanced pilots. With an 81-inch span, the CAP is also IMAA- and IMAC-legal.

Lanier RC CAP 232

by Jim Onorato

THE KIT

Lanier's BFPP (balsa, foam, ply and plastic) large-scale kits have been really successful, and the CAP 232 continues in that tradition. However, Lanier has made several significant improvements to the CAP: top-grade lite-ply is used instead of luan; many of the plywood and balsa parts are laser-cut or router-cut; and the only ABS plastic parts are the cowl, wheel pants and stab cover. (Optional fiberglass cowl and wheel pants are available from Lanier.) The CAP 232 has symmetrical-airfoil foam-core wings, airfoiled foam-core tail feathers and a fuselage made of lite-ply, spruce and balsa. Like other Lanier kits, the CAP does not come with any hardware but does include a complete list of recommended hardware. The kit includes two sheets of detailed, rolled CAD plans and 14-page, step-by-step written instructions.

BUILDING THE FUSELAGE

I used Great Planes* 6- and 30-minute Pro Epoxy on the plywood parts and thin and medium Pro CAs on the balsa and plastic parts. To attach the sheeting to the wing and tail-feather foam-cores, Zap* finishing resin was used, and I used Robart* Super Hinge points on all the control surfaces.

The fuselage is almost entirely built up of lite-ply, spruce and balsa. To build the fuselage sides, I added a forward doubler, a top rail and bottom tri-stock rail, then I installed the laser-cut bulkheads in the precut slots, adding stringers to the top of the bulkheads and then sheeting the fuselage sides with 3/32-inch sheet balsa. I sheeted the bottom of the fuselage with 3/32-inch balsa and drilled and installed the landing-gear block. The engine box, which has been left oversize, has to be trimmed to accommodate the length of the engine you install. The cowl ring is installed over the engine box and against the firewall, and blind nuts are installed to retain it. The cowl is then assembled and glued to the cowl former.

To ensure a square and true fuselage

IMAC aerobat

and to keep the wing spar perpendicular to the fuselage sides, it is important to follow the construction steps presented in the manual when you assemble the fuselage. This involves putting most of the front end together then aligning it with the fiber wing-spar tube *before* you glue everything together. This is a little tricky, but well worth spending some time on to get it right.

One of the design features I particularly like is the fiber tube permanently installed in the fuselage to accept the aluminum wing spar that holds the plug-in wing panels. This eliminates the possibility of the aluminum wing spars wearing away the holes in the fuselage sides and loosening the wing panels.

The canopy frame is built right on the fuselage and is pretty straightforward. Before I attached the clear canopy, I painted the inside of the cockpit with flat black acrylic paint and installed a Hangar 9* pilot figure.

The two-piece ABS cowl is glued to a ¼-inch plywood cowl ring. The cowl and ring are attached to the fuselage with four bolts through the cowl ring (two from the rear and two from the front). I like this method of mounting the cowl on the fuse because none of the mounting bolts are exposed, and you don't have to worry about vibration causing cracking around the bolts. However, you'll need to add an extension to your screwdriver or ball driver to tighten the cowl-mounting bolts. To make the cowl more durable, Lanier suggests that you fiberglass the inside with 2-ounce cloth. I took the easy way out and used the optional fiberglass cowl available from Lanier.

Lanier recommends that you power the

SPECIFICATIONS

Model: CAP 232

Manufacturer: Lanier RC Inc.

Type: unlimited aerobatic aircraft

Wingspan: 81 in.

Wing area: 1,275 sq. in.

Airfoil: symmetrical

Weight: 17 lb., 8 oz.

Wing loading: 31.6 oz./sq. ft.

Overall length: 79.125 in.

Radio used: Futaba* 7-channel with seven standard servos and remote kill switch

Engine req'd: 1.5 to 3.2 2-stroke or 1.6 to 3.0 4-stroke

Engine used: Quadra 42 2-stroke

Muffler used: Slimline giant-scale Pitts-style

Prop used: 18x12 Top Flite Power Point

List price: $499.95

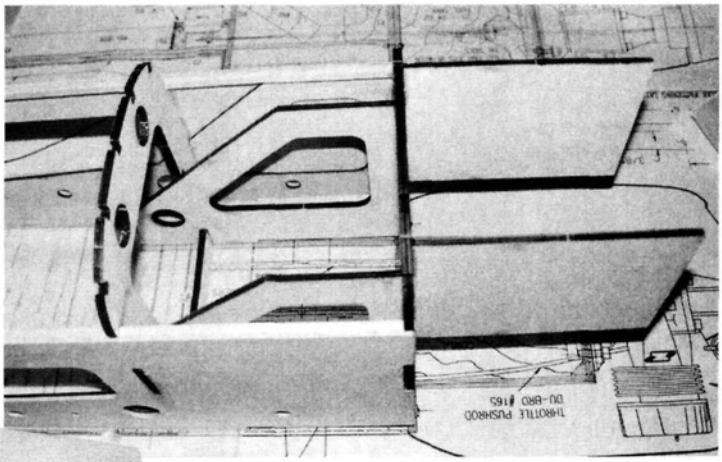
Features: a built-up fuselage using laser- and router-cut balsa and lite-ply parts with built-up balsa turtle deck and canopy sections. The symmetrical-airfoil wings and tail feathers are balsa-sheeted foam-cores. The plug-in wings use an aluminum spar. The kit also includes a vacuum-formed canopy, ABS plastic cowl, stab cover and wheel pants and hefty formed-aluminum landing gear. The rolled plans are CAD-generated.

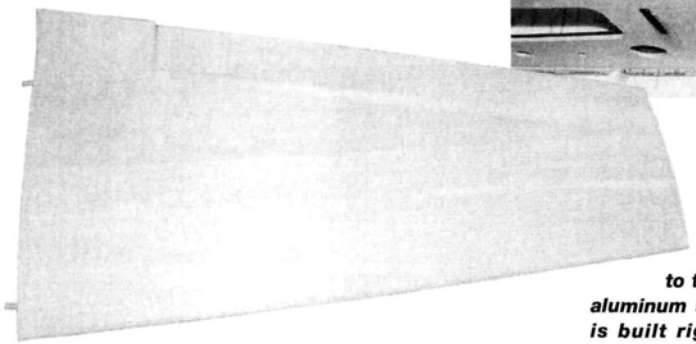
Comments: because it's legal for IMAA and IMAC competition, the Lanier CAP is a great model for aspiring aerobatics pilots. It's also easy to build and a lot of fun at the field.

Hits
- Excellent flight performance and low-speed stability.
- Easy-to-follow plans and instructions.
- High-quality foam-cores and laser-cut plywood parts.
- Good looking.

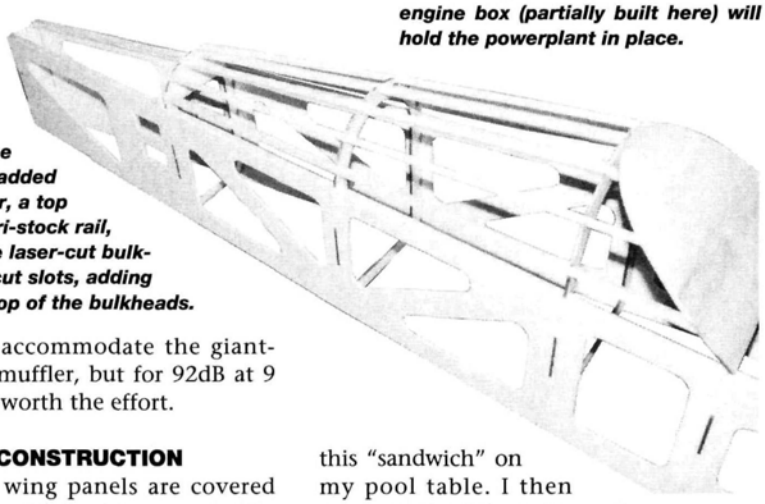
Misses
- None.

CAP with a 1.5 to 3.2 2-stroke or 1.6 to 3.0 4-stroke engine. I used a Quadra* 42CD gasoline engine, which falls somewhere in the middle. I trimmed the sides of the engine box to accommodate the Quadra and installed the firewall top, bottom and ½-inch tri-stock braces. In accordance with Quadra's recommendation, I beefed up the firewall to ½ inch. I used 30-minute epoxy to glue all of the engine box parts and fuelproofed them with Hobby Poxy* paint. I had to modify the engine box to accommodate the giant-scale Slimline* muffler, but for 92dB at 9 feet, it was well worth the effort.





Left: the foam-core wing panels are covered with 3/32-inch sheet balsa. They are double tapered with symmetrical airfoils and are attached to the fuse with a 1-inch-o.d. aluminum spar. Above: the fuselage is built right over the plans. The engine box (partially built here) will hold the powerplant in place.



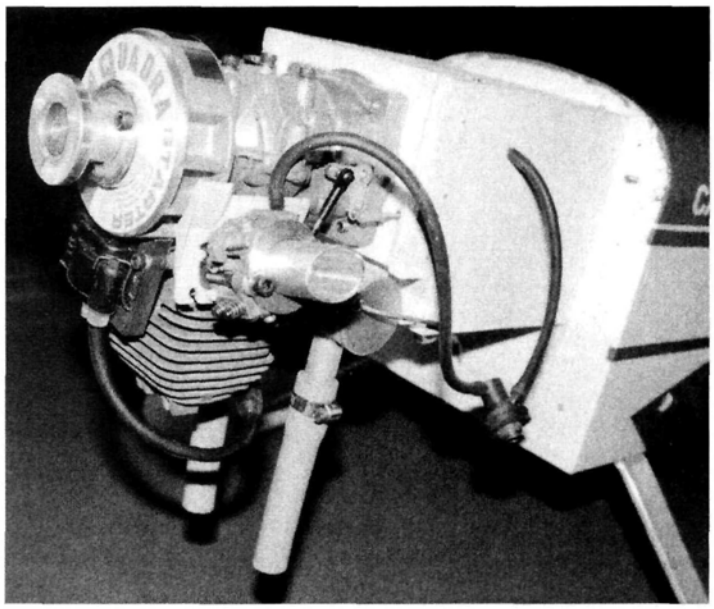
Right: the fuselage is almost entirely built up of lite-ply, spruce and balsa. To build the fuselage sides, I added a forward doubler, a top rail and bottom tri-stock rail, then installed the laser-cut bulkheads in the precut slots, adding stringers to the top of the bulkheads.

WING CONSTRUCTION

The foam-core wing panels are covered with 3/32-inch sheet balsa. They are double tapered with symmetrical airfoils and are attached to the fuse with a 1-inch-o.d. aluminum spar. The foam-cores are precut and have to be handled very carefully because of their delicate feathered trailing edges. The spar hole has been cut out to provide a slight dihedral to the wing panels after they've been joined. I identified the right and left panels and marked the top of each before I continued.

I used 30-minute Pro-Epoxy to glue in the fiber wing-spar tubes then began the somewhat laborious task of preparing the wing skins. Each of the four wing skins required six and a half sheets of 3/32x3x42-inch balsa. That's 26 sheets in all! I trued up the edges of the balsa sheets using a long, steel straightedge and edge-glued them with white glue to make up the four wing skins. While I was at it, I also prepared the 1/16-inch balsa skins for the tail feathers—12 more sheets! I applied the wing skins with a very thin coat of Zap finishing resin. While the resin was curing, I placed the sheeted core in its foam packing pieces and placed this "sandwich" on my pool table. I then covered it with a piece of wood, added six, 5-pound bags of lead shot and let the resin cure overnight. I applied all four skins in the same way. When I had finished, both wing panels were perfectly straight. The 30 pounds of lead shot really did the job!

The remaining work on the wing panels consisted mainly of attaching the leading edges, root and end caps, and cutting out the ailerons and servo wells. I placed the wing panels in their mating foam packing pieces when I cut out the ailerons on my band saw; this kept things nice and square. I then covered the exposed edges of the wing and aileron with balsa as per the instructions. I completed the wing panels by installing two, 3/8-inch anti-rotation dowels in each panel and tapered balsa blocks at the trailing edges to make the panels fit snugly against the fuselage. I used a sharpened ½-inch-o.d. brass tube to make the aileron-lead holes in the wings.



A Quadra 42CD gas engine was proved to have sufficient power to haul the CAP straight up for about 200 feet. I had to modify the engine box to accommodate the giant-scale Slimline muffler.

ASSEMBLING THE TAIL GROUP

The foam-core tail surfaces are covered with 1/16-inch sheet balsa and have symmetrical airfoils. Their construction is similar to that of the wing in that it consists of sheeting the cores, cutting the elevators from the stab and the rudder from the fin, then covering the exposed ends with balsa.

After I attached the stab and fin to the fuselage, I made some modifications to the aft end of the fuselage. Lanier provides an ABS stab cover to form a fairing between the end of the turtle deck and the trailing edge of the stab and, just like the full-size 232, the model doesn't have any type of fairing between the fin and the fuselage aft of the stab hinge line. I decided to install carved-balsa fairings from the end of the turtle deck to the end of the fuselage and to omit the ABS stab cover.

FLIGHT PERFORMANCE

The first test flight and photo shoot took place on a beautiful sunny day with a light breeze blowing diagonally across the field. My transmitter was set up so that "high rate" would give the control-surface throws recommended on the plans and "low rate" would give 70 percent of those values. I used low rate for the initial takeoff.

• TAKEOFF AND LANDING

After range-checking my radio with the engine at full throttle, I topped off the tank and fired up the Quadra for the initial flight. On takeoff, the tail lifted almost immediately, and the CAP tracked straight ahead without any right rudder. I let it roll about 75 feet then applied just a touch of up-elevator. The CAP lifted smoothly into the air with the wings perfectly level. Just two clicks of down-elevator trim were all that was needed for straight and level hands-off flight.

With the Quadra at idle, the CAP settled in for beautiful wheel landings and smooth rollouts. However, because I was using a 12-inch-pitch prop, it sometimes came in a little too fast. In those cases, I used the remote switch to kill the engine just before touchdown.

• LOW-SPEED PERFORMANCE

The CAP is smooth and predictable at slow speeds. I took it to a safe altitude and reduced the throttle as I applied more and more up-elevator. The stall was gentle and straight ahead. The plane can be flown at a very slow speed without losing stability and can execute all but vertical maneuvers at part throttle.

• HIGH-SPEED PERFORMANCE

I should say "full-throttle performance," since the CAP really didn't fly very fast with the Quadra 42. It flew at a very comfortable scale speed and tracked extremely well at full throttle. I found it a smooth and stable flier at all speeds.

• AEROBATICS

The CAP is a proven aerobatics airplane and is capable of every imaginable maneuver. I expected it to perform well and was not disappointed. Inside and outside snap rolls were things of beauty—just fast enough to be appreciated. Axial rolls were fast and truly axial. Sustained knife-edge and outside 360-degree turns were no problem for the CAP. Spin recovery was within ¼ spin when the controls were released. Only slight down-elevator was required to maintain level inverted flight.

The instructions call for "all the rudder throw you can get," but, watch out, because the CAP is extremely sensitive to rudder control.

Although the Quadra 42 was not powerful enough to give unlimited vertical performance, it had sufficient power to haul the CAP straight up for about 200 feet and had no trouble with most other maneuvers.

FINISHING UP

The instructions call for you to glue the two-piece, ABS plastic wheel-pant pieces together with CA and reinforce them on the inside with fiberglass tape. I took the easy way out and used Lanier's fiberglass pants.

Setting the wing incidence is critical, yet fairly simple to do. After I glued on the stabilizer, I blocked up the fuselage so the stabilizer was at zero incidence; then I slid the wing spar into the fuselage and slid one of the wing panels onto the spar all the way until the ⅜-inch anti-rotation dowels were in the holes in the fuse. I set the incidence at zero using a Robart Wing Incidence Indicator, then I carefully slid two FS4s over the dowels and epoxied them to the inside of the fuselage. I repeated the procedure for the other panel. Each wing panel was attached firmly to the fuselage with two, ¼-20 nylon bolts threaded into the root of the wing. I thought this was an excellent way to secure the wing panels to the fuselage.

I finished the CAP with teal, white and light violet MonoKote* and used teal spray LustreKote* on the cowl. The LustreKote was a close but not perfect match with the teal MonoKote. Final touches included a Hangar 9 pilot figure, an 18x12 Top Flite* Power Point prop and a 3½-inch TruTurn* aluminum spinner.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* +

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

HANGAR 9 Cessna 182

by Robert Van Tassel

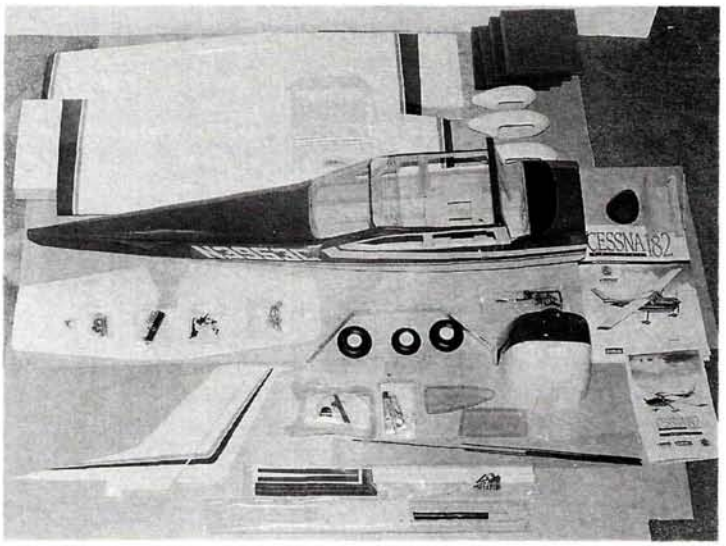
Along with the Piper Cub, the Cessna 182 is probably one of the most recognizable planes in general aviation. Take a look at most of the high-wing trainers on the market today and you'll see the unmistakable Cessna lines. When the opportunity presented itself to review the Hangar 9* Cessna, I pounced on it like a flea jumps onto a dog. I descended to my dungeon, box in tow. I opened the box and just stared. It looked so good, why not just leave it that way? But R/C planes are meant to fly—at least, mine are.

A sweet-flyin' sport ARF

PHOTOS BY ROBERT VAN TASSEL

The kit comes with a detailed manual with clear photographs on each assembly step. An example is the attachment of the ailerons, which is shown in four photos, and you only need to apply CA to prehinged ailerons!

My Cessna came covered in blue and white Ultracote. It's also available in red and white. Even though the plane had been subjected to heat and cold over a few days, there were no wrinkles in the covering. The fiberglass cowl comes painted and completely detailed, but the blue trim paint did not line up with the body trim on one side. The fiberglass wheel pants are painted; only trim striping had still to be added.



The kit components—practically everything you'll need to assemble the Cessna 182.

ASSEMBLING THE WING AND TAIL

Following the manual, I secured the ailerons with thin CA. The Cessna requires aileron servos in the outboard section of each wing. Before I proceeded to the second step of joining the wing halves, I ran a drawstring from each servo pocket to the inboard section of the wings, taking it out through the lower side of the wing near the wing root. I was then able to insert the servo wire and extensions. Be sure to tuck the strings into pockets and have the wing halves flat on the building board when you join them. A hardwood joining block is placed on the front lower portion of the wing root. Lining the wings up correctly is important because the Cessna does not have dowels to join the front of the wing to the fuselage. Aileron installation is straightforward and is shown in detail in the manual. I used the aileron spacers, which bring the servos out of the wing a little (this step is covered in an addendum to the manual, and the parts are supplied).

Attaching the wing to the fuselage is straightforward. "Measure twice and cut once" is something I've learned in woodworking, and in this case, measure twice to be sure of proper wing alignment before you drill the holes for the rear of the wing hold-down bolts. Tape the joint where the wing halves are joined. At the rear of the wing, a hold-down plate is added after the wing has been joined to the fuselage.

To attach the tail feathers, simply cut out the slots provided for the fin and stabilizer. Trim off the covering where it will contact the fuselage, taking care not to cut into the wood underneath, as you will weaken it. I put the wings back on, and because I had put them on squarely, I was able to use them to square up the stab. I lined up the fin, epoxied it into place and CA'd the hinges for the rudder and stabilizers. The elevators are not joined but are controlled by one pushrod with a Y connector.

ENGINE AND GEAR INSTALLATION

The manual calls for a .56 to .65 4-stroke or a .40 to .50 2-stroke. I wanted my model to fly as closely to scale as possible, so I powered it with a Saito* .56 Golden Knight. I installed the same engine in my Hangar 9 Cub and have had great success with it. The installation was straightforward. I opened the cowl a little so the engine wouldn't overheat. The muffler on the Saito was a perfect fit through the opening in the firewall, and an extension exited the exhaust through the forward belly of the fuselage.

I installed the spring-loaded nose gear temporarily, as it would have to be removed later to allow the steering rod to be installed. I used machine screws and the preinstalled blind nuts to install the landing gear, but the manual calls for wood screws. The balsa block that covers this assembly was then epoxied into place. Be careful; there is a forward end and an aft end. Check the contour of the fuselage before you glue it into place.

SPECIFICATIONS

Model: Cessna 182

Manufacturer: Hangar 9

Type: sport scale

Wingspan: 66 in.

Wing area: 579 sq. in.

Weight: 6 lb., 10 oz.

Length: 52 in.

Engine req'd: .40 to .50 2-stroke or .56 to .65 4-stroke

Engine used: Saito .56 Golden Knight

Radio req'd: 4-channel with five servos (throttle, rudder, elevator and two ailerons)

Street price: $209

Features: ARF covered with Ultracote; prehinged ailerons; comes with a fiberglass cowl and wheel pants; detailed instruction manual.

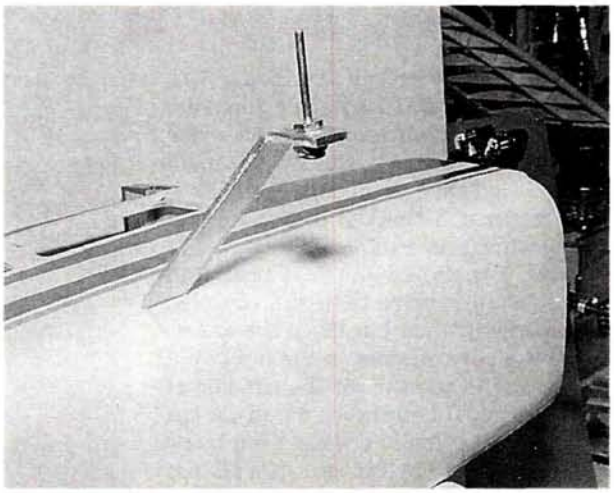
Comments: the Hangar 9 Cessna 182 is a high-quality, easy-to-assemble ARF that looks great and flies well.

Hits
- Good looks.
- High quality of construction.
- Outstanding assembly manual.
- Fiberglass parts.
- High-quality covering.

Misses
- Wheel pants and axles made flying off a grass field difficult.

FINISHING UP

I covered the front of the large forward bulkhead with MonoKote* black trim tape to make it blend in. I installed the wheels and wheel pants according to the instructions' addendum. Because the wheel pants are fiberglass, I took some time to be sure of clearances. I flew the plane off a grass field, and the small front 2-inch wheel with shock absorber presented a problem: it dug in and would not roll. To rectify this, I removed



The landing gear is installed with machine screws and preinstalled blind nuts.

FLIGHT PERFORMANCE

I put on a 12x7 prop, broke in the engine, range-checked the radio, rechecked the balance and double-checked the throws to be sure they were set to the manual's recommendations for high rate. I reduced the throws on low rate and cranked in a little rudder coordination with the ailerons. Jim Onorato, my good friend and chief test pilot, took the sticks, and I grabbed the camera.

Wait! Not so fast! The grass was about ½ inch high, and the plane munched to a stop. We tried about half a dozen times to get the plane airborne, but to no avail. So it was back to the shop for some modification (see the main part of this review).

• TAKEOFF AND LANDING

The takeoff run was straight and true, and steering correction wasn't necessary. About 100 feet out and after we had added a little up-elevator, the model broke ground. The climb was slow and gentle; a little aileron trim and the plane was upward bound.

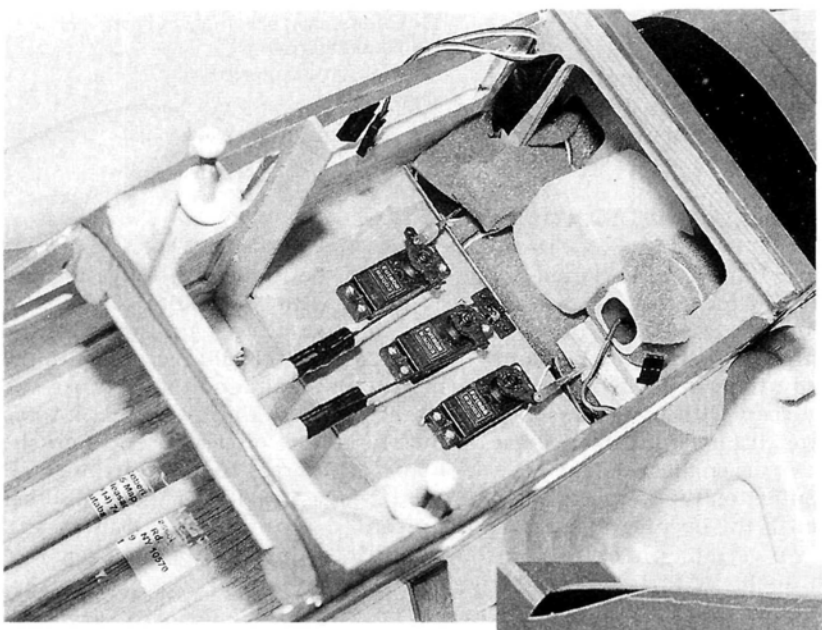
The glide was long and flat and at a reasonable speed—enough to give us time to think. Final was straight and flat with a touchdown on all three wheels and about a 15-foot roll-out on the grass.

• LOW-SPEED FLIGHT

Jim flew the Cessna back and forth over the field, banking and turning at slow speed so I could get the pictures. The model was rock steady. With it up at about 200 feet, Jim powered way back and fed in up-elevator until it stalled forward, dropped about 15 feet and then just started to fly again. A slow loop was surprisingly tight. Jim was flying at about ½ throttle. The Cessna was very sensitive to elevator input. Even at low rate, I will have to take some of the throw out. It has a lot of surface. At slow speed and low rates, the Cessna requires the coordination of the other control surfaces for rolls.

• AEROBATICS

This is a stand-off-scale plane; it can do a lot more than its full-size counterpart. On high-rate aileron and with a little speed, it rolled at a good rate. Inverted flight was no problem, and the loops became tighter. Spins were tight. Does the 182 fly like a CAP or any other aerobatic plane? No, and it isn't supposed to, but it does very good aerobatics for a high-wing plane.

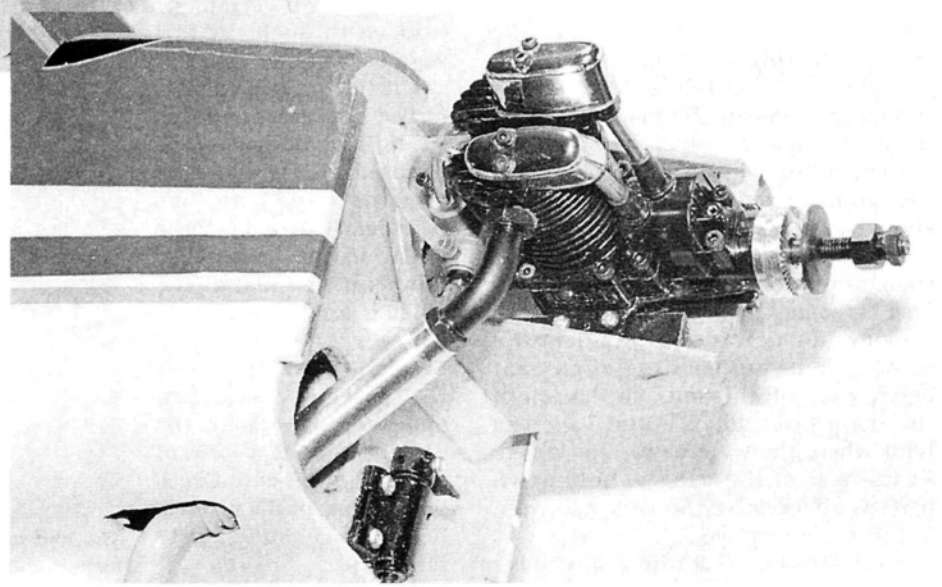


Left: there's almost enough room in the fuselage for you to climb in and work!

Below: a Saito .56 Golden Knight provides scale-like power.

the shock absorber and installed a 1½-inch front wheel. I also made sure that the larger front wheel cleared the wheel pant. I used Du-Bro* axles on the main gear and attached them with Sig* wheel-pant retainers. I checked to be sure that all the wheels turned freely.

Next, I installed the fuel tank and packed it into place with the supplied foam padding; then I installed the servos. There is plenty of room in the fuselage. I ran a switch extension to the left side of the fuselage. The pushrods are made out of two supplied balsa dowels. I put a few drops of thin CA on the dowels for strength. The windshield and rear and side windows were a perfect fit. With the addition of the trim tape to the cowl and the wheel pants and the installation of the non-functional wing struts, the main assembly was complete. The radio gear is padded with supplied foam. I checked the balance; the plane didn't require any changes and was ready to fly.



FINAL THOUGHTS

Do I like the plane? You bet I do. Hangar 9 has a winner with this Cessna 182. It would make an excellent second plane if you've had some aileron experience. The next time you're outside and look up and see a Cessna 182, give a wave; it might just be mine!

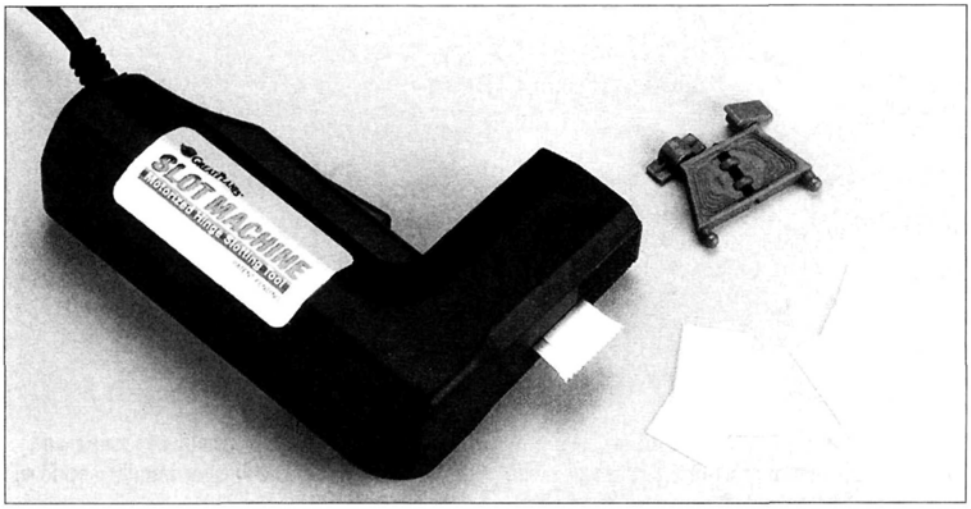
**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ✚

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

GREAT PLANES

Slot Machine

by Larry Marshall



SPECIFICATIONS

Product: Slot Machine

Manufacturer: Great Planes Mfg.

Street price: $29.99

Features: comes with blades to cut CA hinge slots. Additional blades are available for thicker nylon hinges.

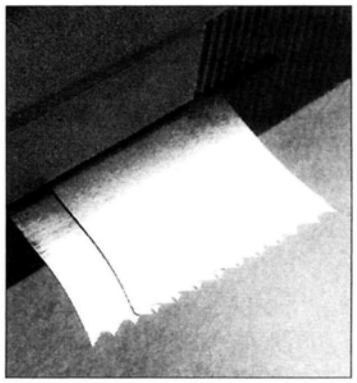
Comments: this is the slickest way to cut slots you'll find available today. It's also useful for cutting servo wells and hatches.

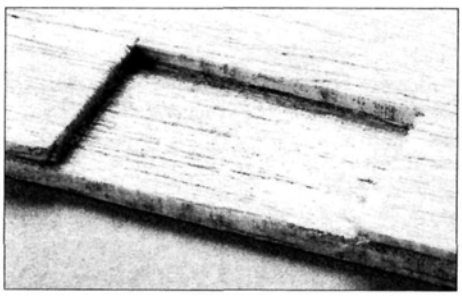
Hits
- Easy to use.
- Does a great job of producing consistent, perfect hinge slots.

Misses
- Should have been invented a decade ago.

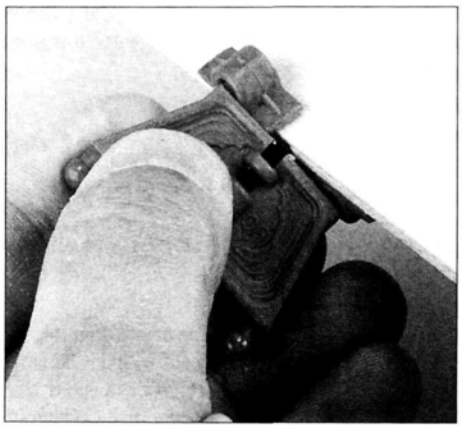
BILL WARNER wrote a book titled "Hey Kid, Wanna Build a Model Airplane?" and I suspect that most of you who read our magazine have answered that call. But can you imagine building a model airplane without an X-Acto knife? Do you find a Dremel tool indispensable? Well, every once in a while, a new product comes along that falls into this "Gotta have one" category of tools, and I think the Slot Machine from Great Planes* is just such an item.

I first saw the Slot Machine at the Chicago show and couldn't believe what quick work it makes of the otherwise dreaded job of cutting hinge slots. Not only does it do it quickly, but it also improves the end result.





I opened up a hinge slot to let you see how crisp and smooth they are.



The Slot Machine comes with a set of blades that cut a perfect, square slot that's just the right thickness for CA-type hinges. In one of the photos, I've made a hinge slot and then removed the balsa on one side of it so you can actually see the insides of the slot. You'll see that it's very smooth and very precise—just a bit wider than the hinge itself and, at least with the hinges I have, exactly half the length of the hinge. As the back of the slot is square, the hinge fits perfectly. While I haven't seen them, you can also buy a thicker set of blades for nylon hinges.

When buying your Slot Machine, make sure you also pick up one of Great Planes' new hinge marking tools. This is a nifty little gadget that scribes a shallow groove in the middle of a control surface (from 1/16 to 1 inch thick), and this groove acts as a perfect guide for establishing where the Slot Machine blades should be positioned. Then, it's just a matter of pushing the button on your Slot Machine and maintaining a light pressure as the blades quickly make a perfect slot.

I've just gotten my Slot Machine, so I haven't had a chance to really investigate its potential, but I think uses beyond hinge slotting will be found for it. I did play a bit with a piece of 1/8-inch scrap balsa, and it seems that anything that requires a plunge cut would be a potential job for the Slot Machine. I cut a triangle out of my sheet and found that the Slot Machine can cut across grain as well as with it, so making small hatches, slots, etc., should be within its grasp. I know which tool I'll use the next time I need to cut open a servo bay. With some depth jigs and such, I think even more uses for it might be found. In any case, I'll never cut another hinge slot without my Slot Machine.

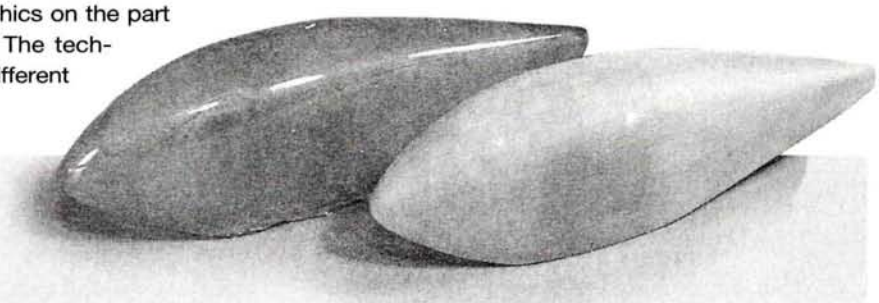
**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

by Faye Stilley

Cover Fiberglass with MonoKote

Pants to match

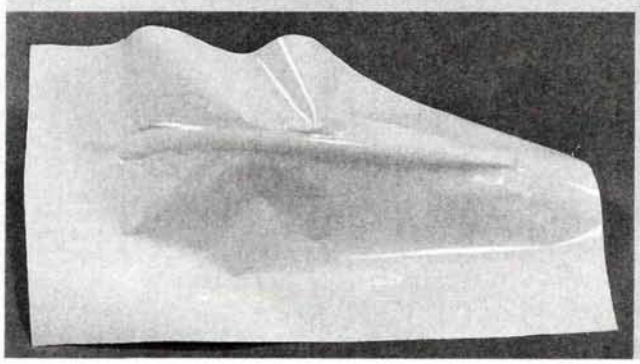
A fiberglass model airplane part doesn't have to be painted. I've heard horror stories about fellows spending $40 a quart to have paint mixed using a spectrum analyzer and still not getting an exact match to their film covering. You can be sure that your fiberglass parts will match the rest of the airplane only if you cover them with the same film; any graphics on the part will also match the airplane's trim-color scheme. The techniques used to cover fiberglass are only slightly different from those used to cover wood.



1 Preparing fiberglass for film covering is similar to preparing it for painting. First wash the parts thoroughly with soap and water to remove any release-agent residue. This is an important step. Then prime the part with finishing resin instead of with a paint primer. I've used Sig* polyester resin and Pacer* Z-Poxy finishing resin with equally good results. Depending on the quality of the fiberglass part, it will take from one to four coats, sanding between coats, to achieve a smooth finish. The objective is to get a satin finish, fill any pinholes and make the coating thick enough to prevent the weave of the fiberglass from showing through the film. Not all epoxy resins and polyester resins are compatible.

Before proceeding with the whole project, it is a good idea to do a small test on the inside of the part. If the resins aren't compatible, the coating simply won't cure; it won't damage the part. The wheel pant in the foreground has been sanded and is ready for covering. Even though you can see the weave in the glass, you cannot feel it. I used 220-grit sandpaper to smooth the surface and 400-grit sandpaper to polish it to a satin finish. The other pant has been coated with resin but not sanded. Resins cure to a high-gloss finish and are easy to sand.

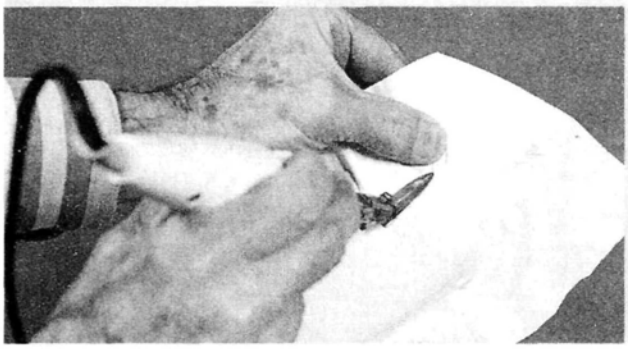
2 When working with a compound curved surface, iron the film onto the highest point of the curve first. Once attached from end to end, the film can be heated and stretched around the milder curves. A small covering iron with a rounded shoe works best for this; with the iron set at 220 to 230 degrees Fahrenheit, work fore and aft in "rows" of about $\frac{1}{8}$ inch to $\frac{3}{16}$ inch width. On each pass, heat the film until it becomes rubbery, stretch it until it conforms to the part's shape, then press it down onto the surface. Let the heat do the work; very little pressure is required.



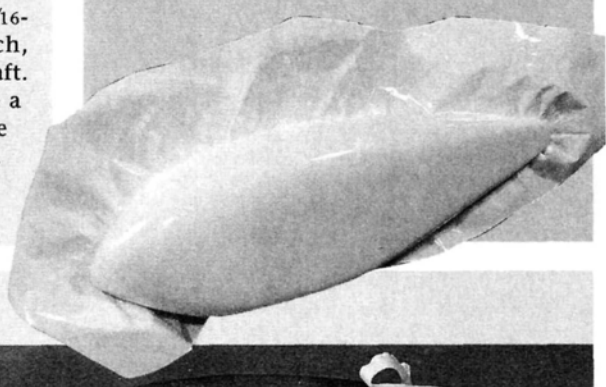
PHOTOS BY FAYE STILLEY

3 As you make your way away from the high point and down the side of the more mildly curved surface, make broader passes, perhaps ¼ inch to ⅜ inch wide. Lay the shoe of the iron on its side and use the "sole" to heat the film before it is stretched; then stretch it and slightly apply pressure with the side of the shoe. Note the position of the iron. I am heating the film in the area that will next be stretched into place. After pressing the film onto the surface, hold it in place. It needs to cool for the adhesive to attach firmly. Fiberglass does not dissipate heat as quickly as wood, so be prepared to hold the film in place for 3 to 5 seconds.

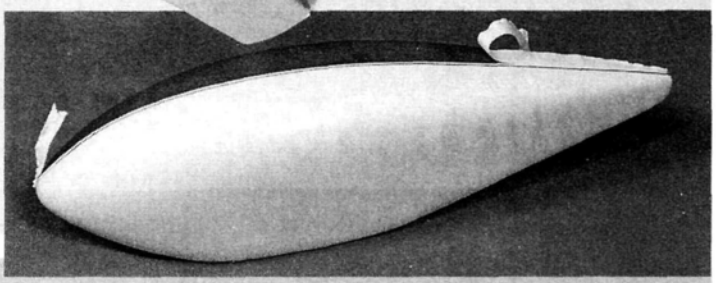
4 Here, the side of the pant is finished, and I am beginning to stretch the film around to the underside. The curve is quite sharp, and the bottom of the pant is nearly flat. In this situation, more heat needs to be applied, and more pull will be required to stretch the film around the curve. I have switched to a flat shoe on the iron and increased the temperature to the 260- to 280-degree range. The flat shoe works best because you can use just its tip to make narrow, 1/16-inch to 3/32-inch, passes fore and aft. Sharp curves take a little more time than nice, big, round ones.

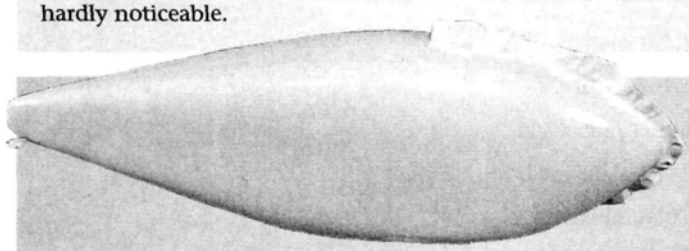


5 Here, one side of the pant is nearly complete. The covering extends just past the centerline along the top and bottom of the pant. To cover the top of the pant, I used the small rounded shoe, using the same technique as I used on the side. I was able to make fore and aft passes a little more than ¼ inch wide from the high point to the centerline.



6 Draw a centerline, end to end, on the top and bottom of the pant. A small metal measuring tape makes the task easy; mine is on a key chain and is only 3/16 inch wide. Mark the center at the forward and aft ends of the pant. With masking tape, anchor the measuring tape on one end. While holding the tape in place, draw the centerline using a fine-line permanent marker. Cut the excess film away 1/32 inch beyond the centerline. The final seam will be only 1/16 inch wide and hardly noticeable.

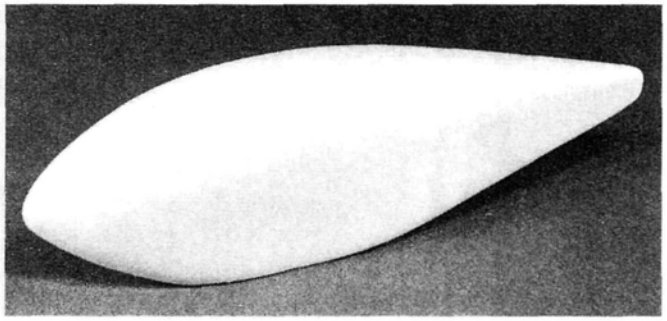




7 The reverse side of the pant is near completion and has been partly trimmed. If you look closely, you'll see that the top seam overlap is hardly visible. When approaching the seam area with film on the second side, be particularly careful not to seal it to the film that is in place. Stop short about 1/16 inch away. Use alcohol to remove the centerline you drew previously. Carefully ease the film up to, but not over, the film that's in place. Once again, with the small measuring tape, draw a line fore and aft. This time, draw a "cut line" rather than a centerline. This is the line you will follow to remove the excess material. Using the metal tape as a guide, draw a new, no. 11 X-Acto blade over the film. The object is to cut through the top layer of film without cutting the underlying film. It will take more than one pass with the knife. On the first pass, you will gently scribe the line without cutting through the film. Then you remove the measuring tape, and the scribe line will guide the blade on subsequent passes. You will find that you can cut through the film without cutting through the adhesive layer underneath; then just pull the excess film away.

8 Here, the excess material has been removed and the seam has been sealed with heat. The cut line has been washed off with alcohol, and the pant is ready to be decorated with whatever graphics you choose. Not only does the pant exactly match the color of the airplane, but any graphics will be an exact match as well. As a bonus, your graphics will cost nothing because you can probably make them all from scrap covering material. You won't have to spend your whole allowance at the automotive paint store after all.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ✈



Nieuport

by MARTIN IRVINE

The model presented here is based on Nexus 3-view drawings from England that are available in the U.S. from Bob Holman Plans Service*. Recently, an Albatross Publications* "DataFile" was published on the Nieuport 12, and I recommend it as the best source of scale information.

The model came about due to a couple things. First was the success and attractiveness of a 38-inch Speed 400 version I built several years ago. Second was the availability of the ModelAir Tech* 3.6:1 belt drive, which I powered with a DeWalt drill motor. The idea of building an IMAA-legal airplane and powering it with a $110 drive system was too good to resist!

The Nieuport 12 is scaled to use the widely available 5-inch Williams Bros.* vintage wheels. My original target weight was 7½ to 8 pounds, and test flights were made at 8 pounds. The dummy engine, pilot and gunner figures and machine gun added 12 ounces for a total of 8¾ pounds.

CONSTRUCTION

• **Tail.** I suggest that you build the tail first. It is easy to build and gives you something to look at fairly quickly. I built the stab so it's detachable, but so far, I haven't had to remove it for transportation. The rudder has a laminated outline and a somewhat unusual but very functional hinge. It is detailed on the plan.

• **Wing.** The top wing uses the same airfoil as the Proctor Nieuport 11 and Antic. I like this airfoil because it works well and looks the part. A scale airfoil is heavily cambered but thin. The Antic airfoil has a similar top-surface curvature but is thicker. There is just enough undercamber to give the looks of a WW I model, and it isn't too difficult to cover.

The lower wing airfoil is a Clark Y. On the original, the lower wing was really only a streamlined spar to provide a bridge structure for the wing bracing. On this model, the two panels plug into the fuselage, and all the lifting forces that act on them go through the struts to the one-piece top wing.

An unusual WW I two-seater for electric or glow

12

SPECIFICATIONS

Model: Nieuport 12

Type: WW I two-place biplane

Wingspan (top/bottom): 68/63 in.

Length: 54 in.

Weight (ready to fly): 8.75 lb.

Wing area: 1,250 sq. in.

Wing loading: 16.12 oz./sq. ft.

Airfoil (top/bottom): undercambered/Clark Y

Radio req'd: 4 channels (rudder, aileron, elevator, throttle)

Power req'd: 400 to 500W belt-drive electric motor or .60 to .80 4-stroke glow engine.

Power used: DeWalt drill motor with ModelAir Tech belt drive

Comments: designed by Martin Irvine, the Nieuport 12 is an attractive, unusual, two-place WW I biplane built of balsa, ply and spruce. Construction is light and strong; some laminated parts must be made. This model is not recommended for beginner builders or fliers.

Start by building the top wing main spars. They have balsa cores and 1/8x3/8-inch spruce tops and bottoms. Use a level table and a straightedge to make sure they remain straight while the glue dries. All the ribs are cut from the same basic pattern. Trim the center ribs to length, and cut the aileron ribs at the spar and at the aileron LE lines. Note that the ribs between the center section and the aileron have holes for the aileron torque tube. These are reinforced with 1/64-inch or 1/32-inch ply washers as shown on the drawing.

Shim the spars so that the ribs are 1/16 inch above the building board. They will rest on the 1/16x5/8-inch TE. The LE rests on the building board, allowing room for 1/16x1/4-inch capstrips to be added later. Add the top TE piece, the capstrips and the laminated tip. The tips are supported by balsa extensions at the spar locations and are built to give the illusion of a thin airfoil. I suggest that you build the ailerons at the same time as you build the wing panels. You can cut the tip and TE free later. Remember, though, that a fiberglass torque tube will be added before the wing panels are assembled. Don't jump ahead too quickly.

The center section requires extra care in assembly, as it will be stained and covered with clear MonoKote* or a similar covering, so your workmanship will be on display.

The center-section TE will have to wait until the wing is assembled, as the laminated part is used to connect the three panels. The aileron control quadrants can now be built. This is a scale item, as is the method of actuating the ailerons. I made mine from a 1/16-inch-thick fiberglass sheet core and added 1/16-inch ply on either side. I also added carbon-fiber tow between the laminations for insurance, but this was overkill. File and sand the quadrant to an oval cross-section, then check the fit with the torque rods. Also check the rod's fit through the rib holes and eliminate any binding. The two end holes are the critical ones; you don't want any slop here.

When fitting the quadrants, you have a choice: you can build the center section around them (the rear spar goes through the quadrants), or you can carefully break the outer rib, put the quadrant on the spar and replace the rib. Either way, you have to deal with them waggling around during the rest of construction. Sorry! I've marked three holes in the quadrant for the pushrods. The one farthest away from the spar is the scale position, but this gave far too little aileron throw. I had to move the pushrod in a lot.

Now join the wing panels. The dihedral braces are strips of 1/2-inch-wide 1/16-inch ply applied to the front spar and rear

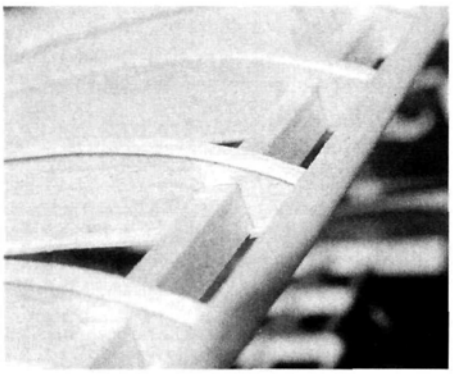
spars. Thin ply allows a bend to be put in so that the braces can be epoxied to the sides of the spar where they will be the strongest. Multiple layers make the joiner strong. The top wing has no dihedral, so glue things together on a flat surface and shimmed up to clear those pesky quadrants. (Actually, this will result in a slight dihedral angle because the chord-line angle is positive, but don't worry about it.) Add the laminated center-section TE and sand to shape. The lower surface capstrips can now be glued on. Use flexible capstrips to follow the rib curvature; the capstrips add a lot of strength.

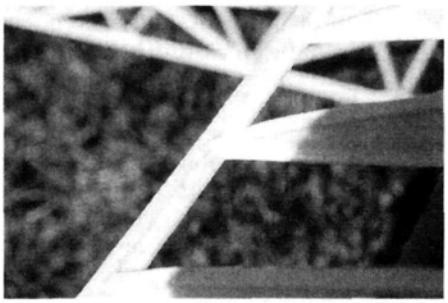
At this point, you can add the strut mounting points—four cabane and four interplane. These are all made from 3/16-inch ply glued to a larger 1/16-inch ply plate. The 1/16-inch ply plate is glued to the bottom of the spar to brace the 3/16-inch ply, which is glued to the front of the spar.

Cut the ailerons free, and fit them to the torque tubes. Sand the LE bevel and "dry-hinge" with Robart* Hinge Points. Note that the hinge line is 1/8 inch behind the LE. This puts the hinge line in the center of the torque rod for minimal binding.

The lower wing is very simple. The spar is in two parts, and there's an upper and lower section with 1/8-inch webbing similar to that on many sport designs. With the moderate camber of the upper surface, the covering is unlikely to droop enough between the ribs to contact the spar. The root is a little different though. On the full-size aircraft, the LE was cut back—for visibility, I think. The wing's major locater is a 1/4-inch brass tube that has a wire hook installed in its center. This tube is bound and glued to the spar. A rubber band is then stretched through the fuselage to hold the two bottom wing panels to the fuselage sides. The 1/16-inch wire pin shown on the plan acts as an incidence gauge.

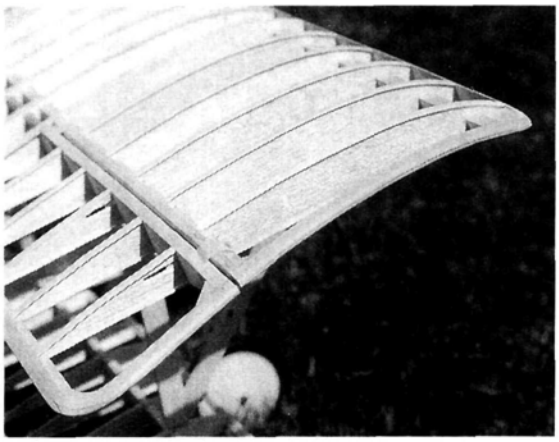
• **Fuselage**. Lay out the main longerons and the forward "fill-in" sheeting—verticals and diagonals—for both sides. I have



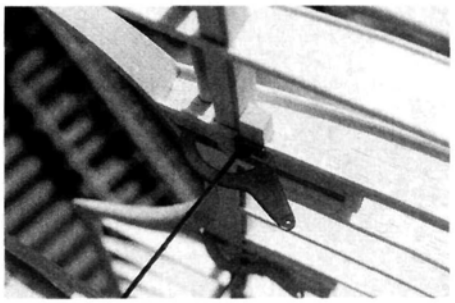


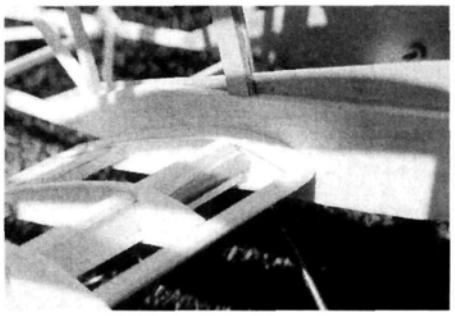
Top: the leading edge, showing the laminated spar—spruce top and bottom—and capstrips. Note how the lower capstrip ties the spar to the front and rear portions of the rib.

Bottom: the trailing edge, showing the two-piece TE sandwich, which gives a thin, scale-looking top but a stronger section.



A laminated wingtip. It has been rounded and the aileron has been cut free.





Above: the underside of the wing center section. This shows the brass strut-mounting tab and bolt, the dihedral brace and the laminated, TE center-section. The aileron quadrant is attached to the torque tube.

Above left: the root section of the lower wing, showing the brass locater tube; just visible to the left is the rear locater-pin bracing. Note how the plywood doubler ties together the wing root, the rear cabane-strut vertical mount, the rear longerons and the rear landing-gear strut mounting.

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING

Takeoff is quite straightforward. Point the model into the wind and advance the throttle. Get ready to catch any slight swing with the rudder, and after about 10 yards, the tail will come up. In another 10 yards, the Nieuport 12 will lift off.

Landings can be done as a wheel landing or the preferred three-point landing. A crosswind is a problem that will likely result in a ground loop, so keep the nose into the wind.

• LOW-SPEED PERFORMANCE

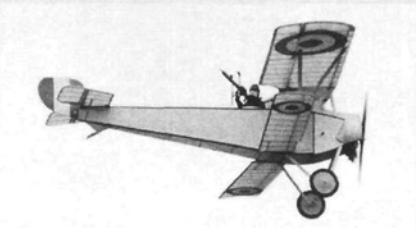
This is what this model is best at. Ailerons are quite ineffective at all speeds, but more so at low speeds. You have to use rudder all the time. If you have built the airframe straight, stalls are gentle and straight ahead.

• GENERAL FLIGHT PERFORMANCE

The aircraft can do all the typical WW I maneuvers, but you will have to add power for maneuvering. There isn't, however, a lot of extra power available because of the increased current drain.

Electrics guru Keith Shaw is much better at aerobatics and advanced flying with a plane such as this, and once, he flew my model in low-level figure-8s. Keith was able to reduce the throttle by one click for each flight circuit while still carefully maintaining altitude; the last click stopped the prop! (Astro 205 controller); so it is quite an efficient airframe at low speed.

Aerobatics are possible only in the broadest sense of the word! Touch-and-go's are the best, but lazy-8s and wing-overs look pretty, too. I once tried a loop at great altitude, but it flopped out before it got over the top, and that scared me enough not to try it again!



had good luck building the second side over the first with wax paper over each joint. Notch both sides for the cabane and undercarriage strut mounts, then sand with a large, flat sanding block that's big enough to take a full sheet of sandpaper.

Add the 1/32-inch ply landing gear and cabane doublers. The front two cabane struts plug into plywood cross-pieces, but the rear strut is mounted vertically in a plywood box channel (see section "A-A" on the plan). This is accomplished by notching the longerons 3/32 inch on the inside edge and slipping the rear strut into the plywood channel.

The fuselage is assembled upside-down. The temporary bulkhead is positioned at the rear landing-gear strut mount. The firewall is used to position the fronts of the fuselage sides, and then the rear ends of the fuselage pieces are simply drawn together and glued at the rudder post. When putting in the horizontal cross-pieces, cut them to length so they position the bottom longerons in a straight line that runs from the firewall to the tail post. The top longerons should be straight from the rear of the gunner's cockpit (former F3) to the tail post. This results in a trapezoidal cross-section. Add the plywood cabane and landing-gear strut mounts. These strengthen the fuselage assembly a lot. Leave the section under the battery area (firewall to landing gear) uncovered, as you will need room to mount the battery pack.

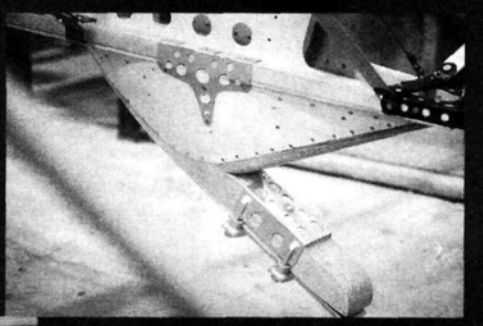
This is the best time to fit the cowl. There are several ways to make one. I used a female glass mold, but a quicker method is to carve one from foam about 1/16 inch undersize then cover it with packing tape and three layers of 6-ounce cloth and epoxy. If you do this on a drill press or use an electric hand drill, it will be smooth and true. Sand the cloth with coarse sandpaper until it is smooth, and smear on a slurry of epoxy and microballoons. Sand with fine paper and finish with wet-and-dry paper. You may need another coat of slurry to fill pinholes.

Once you have the cowl done, you can start on the forward fuselage. It is easier to make adjustments to the wooden parts than to try to deal with a mismatch when things have been completed. To ensure a straight stringer location, I cut the notches in the former as I install the stringers. They stand 1/16 inch away from the formers so that the fabric will touch only the stringers.

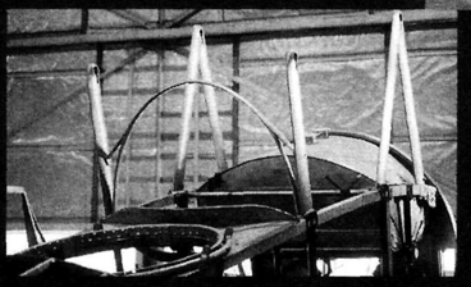
Bend the landing gear and cabane struts up using the pattern on the plan.

THE FULL-SIZE NIEUPORT 12

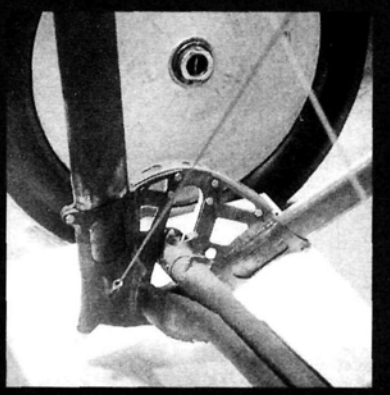
The original Nieuport 12 was a typical 1915 two-seater design. It was a development of the earlier Model 10, the first of the sesquiplanes (one and a half wings) that became the Nieuport trademark. The "10" was also developed into a single-seater—the Nieuport 11 (the famous "Bebe" used by the early French aces and the Lafayette Escadrille).



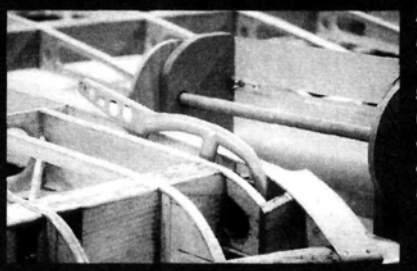
The tail skid bolted to the rear fuselage.



The center-section struts and cockpit.

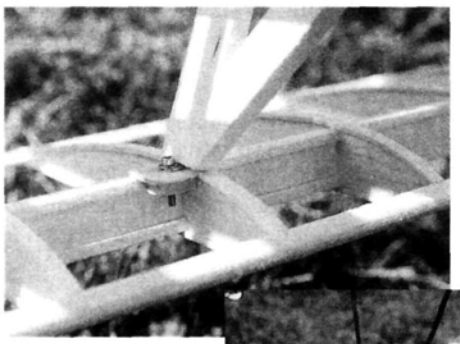


The Nieuport 12 was used by the French, British and Russian air services and was built in Great Britain as well as in France. The only full-size Nieuport 12 still in existence is currently being restored at the Canadian National Air Museum at Rockcliffe Airport in Ottawa. Hopefully, by the time you read this, it will be on display.

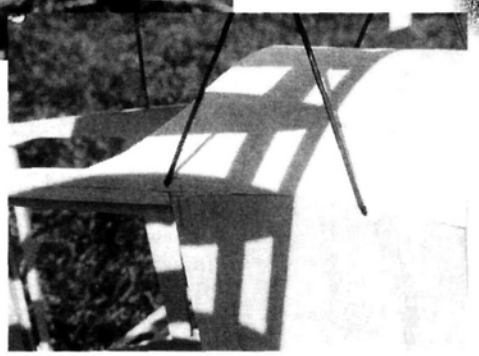


Above: the lower end of the landing-gear struts (showing the axle mount and the travel limiter).

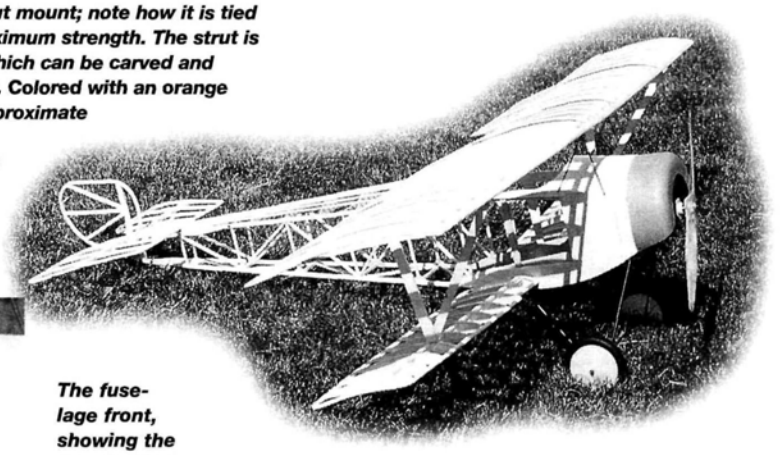
The aileron quadrants mounted in the wing center section.



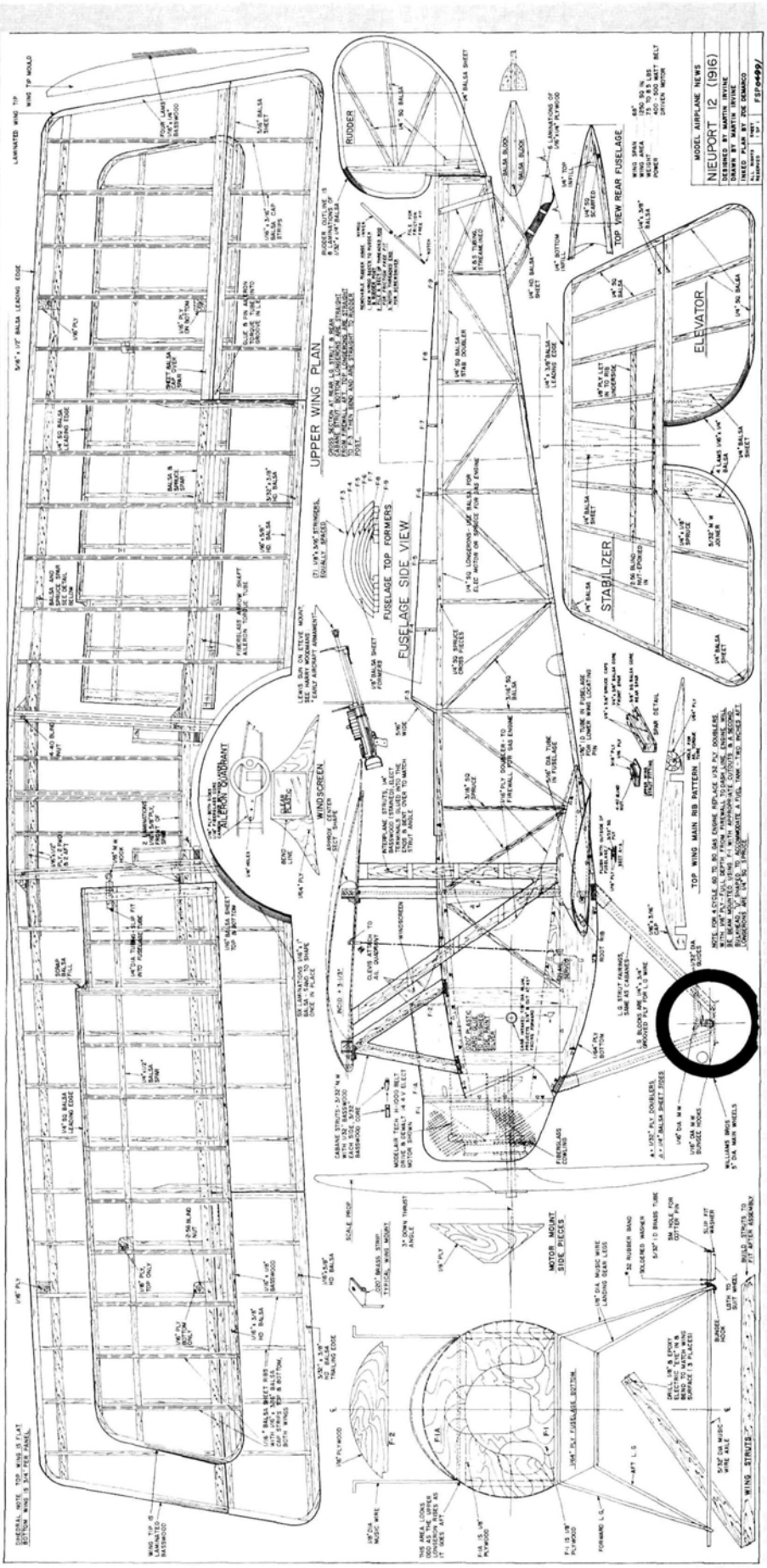
The interplane strut mount; note how it is tied to the spar for maximum strength. The strut is solid basswood, which can be carved and sanded beautifully. Colored with an orange stain to closely approximate the original's varnished spruce, the struts look beautiful when finished.

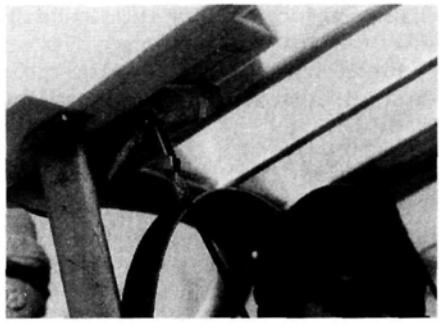


The fuselage front, showing the plug-in strut mounts.



The uncovered airframe is almost too pretty to cover.





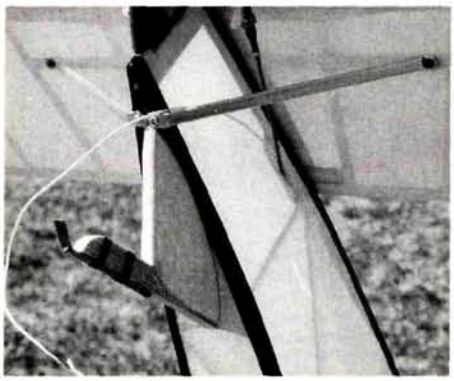
The underside of the finished center section; note the second pushrod hole. The center section is stained with Ipswich Pine (as are the interplane struts) and covered with clear MonoKote. The hoop behind the pilot is a piece of plastic strip.

The top mounting tabs are bent out of 0.0325-inch (0.8mm) brass and drilled to fit the wing-mounting bolts. A hint: when you've completed the tabs, attach the wing with 1-inch-diameter, 1/32-inch-thick ply washers placed between the wing and the tabs. Heat the tabs with a large soldering iron, and as soon as the solder flows, tighten the mounting bolt. The plywood protects the wing from burning, and tightening the bolt while the solder flows ensures that the tabs conform to the bottom of the wing.

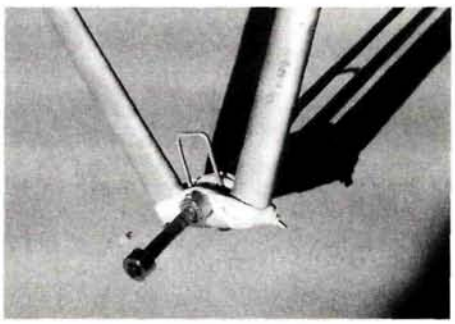
The rear strut is plugged vertically into the fuselage. These have to be well grooved and cleaned before being epoxied into place. The advantage of this method is that the rear strut can be moved up and down a bit to adjust the incidence angle before the epoxy cures. Check the incidence, but don't epoxy yet. The fuselage is much easier to cover and dope with the struts left off. The struts are also much easier to sheathe with basswood while they're off the fuselage.

Now is a good time to assemble the model and fit the interplane struts. These are solid basswood with electric "eye" terminals epoxied into the ends. Check the whole model for incidences and squareness. It is a lot easier to do it now than it will be once the model has been covered.

• **Equipment**. The DeWalt drill motor and ModelAir Tech 3.6:1 H1000 belt drive are mounted on an 1/8-inch ply mount and 3/8-inch maple rails similar to a glow-engine mount. I mounted the battery pack (18-1700 SCRCs) on a plate on top of two rails that run from the forward undercarriage mount to the firewall. Move the battery fore and aft, and once the balance point has been established, leave the pack in place. Add a charge jack and a safety switch when the covering has been completed. The two aileron servos are mounted on each side of the pack with the rest of the radio below and behind them.



The tailskid and stabilizer struts. The struts are K&S aluminum tube, and the strut spar is a piece of 1/8-inch ply. The skid uses a core of 1/32-inch-ply strips laminated together, and a metal tip has been added.*



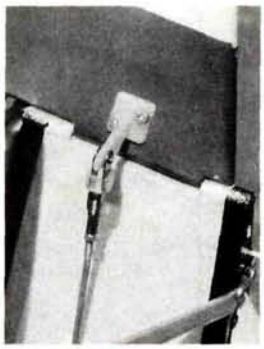
The axle fitting. A single piece of 1/16-inch wire acts as an axle limiter and bungee pegs. (The plan shows a more scale, more complex version.) Two no. 64 rubber bands on either side are held in place by wheel collars. The wheel rides on a length of brass tube.

Glow Conversion

If you want to build the Nieuport and power it with a glow engine, I suggest a 4-stroke .80 or .90. The wings, tail and struts are quite strong enough, but make a couple of changes to the fuselage.

- Replace the 1/4-inch-square balsa longerons with 1/4-inch-square spruce longerons.
- Replace the 1/8-inch firewall with one made of 1/4-inch or 3/8-inch ply.
- Replace the 1/32-inch ply doublers with the larger, 1/16-inch doubler indicated on the plan. You will have to make your own arrangements for the fuel tank.

I would guess that a 6- to 6 1/2-pound model is quite possible—very light!



The rudder hinge is made with sections of inner Nyrod and a wire hinge pin made of threaded rod. At the lower end, this is slotted for a fine screwdriver and thinned after the first couple of threads so that it can be inserted and will pivot freely. The few threads at the end of the pin hold it securely in place.

COVERING AND FINISHING

I covered the model with Sig* Koverall. It comes out of the package white, but for an antique look, I dyed it with Dylon synthetic fabric dye. Balsarite is used to adhere the fabric to the framework. Add three or four coats of low-shrink dope, and you're ready for markings. I used low-tack shelf paper to mask the roundels, and I did each color separately, without overlaps. When the model is flying overhead, the sun shines through just as it should.

I used a pilot and observer from Pete's Pilots*; they're quite light and very true to scale. The scratch-built machine gun and Eteve gun mount and ring are based on drawings in Harry Woodman's book, "Early Aircraft Armament." Regard them as models in themselves, and enjoy building them; they add much to the model's appearance. For details on my dummy Le Rhone engine, see my "How to" article in the January 1999 issue, page 76.

With the cowl removed, you can see the drive motor, belt-reduction drive and dummy Le Rhone engine.

An unusual, seldom modeled WW I airplane, the Nieuport 12 is a pleasure both to build and to fly. I hope you enjoy yours as I enjoy mine.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

atomized, resulting in a finer, tighter spray pattern. I also find this type of brush easier to assemble in that it's essentially self-adjusting.

• **Single-action.** The air valve is simply depressed to release air, and the resulting venturi effect at the tip draws paint from the mixing cup or jar. If it's possible at all, the paint flow has to be adjusted between shots.

• **Double-action.** On a double-action airbrush, depressing the air valve releases only air, and the brush has a separate internal needle valve to control paint flow. To operate the brush, you depress the button to start air flowing, then you rock the button backward to release paint into the airstream. Though it takes a little practice to get used to, this allows you to adjust the paint flow constantly to suit your needs. Believe me, this micro control is a tremendous asset.

Generally speaking (there are exceptions to every rule), the cheapest models are single-action/external mix, and the best units are double-action/internal mix. Photos 1 and 2 show examples of both types.

AIR SOURCES

Of course, you can't use an airbrush without air, so I'd like to take a moment to touch on some compressed-air sources: one of the simplest and cheapest sources is a large spare tire with an appropriate valve that mates with your airbrush's air line. A similar option is a compressed-air bubble. The weakness of both these options is that you have to visit a gas station to refill them, and that can get a little old after the sixth or seventh trip.

A more compact choice is aerosol cans of ozone-safe propellant (photo 3). These have the virtues of being compact and quiet, but you once again have the problem of running out of propellant right in the middle of a painting session. Besides, by the time you've purchased half a dozen cans, you could have paid for a good compressor.

Photo 3: compressed air is available in cans for small jobs

When most people think of air compressors, a piston compressor with air tank comes to mind. Photo 4 shows a very low-cost piston compressor that I bought years ago. I mounted it on a plywood base to make it easier to anchor. This type of compressor works very well, but the racket it produces can annoy family members.

Photo 5 shows a Paasche* diaphragm compressor. In operation, diaphragm compressors are similar to aquarium pumps, and like their smaller brothers, they're very quiet. A first-rate unit that will last indefinitely can be bought for around $100. Frankly, if you've been running back and forth to the gas station to refill your tire or air bubble or shouting over the noise of your piston compressor, the first time you use a diaphragm compressor, you'll wonder why you waited to buy one.

I'm fully aware that some of you are already using modified Freon or propane tanks as compressed air tanks. I do *not* recommend this. First, these light-duty tanks are made of stamped sheet metal and are not designed for repeated high-pressure use. Second, with no water trap or interior coating, they're prone to corrosion that will weaken them over time. With all the other options, this just isn't a good tradeoff.

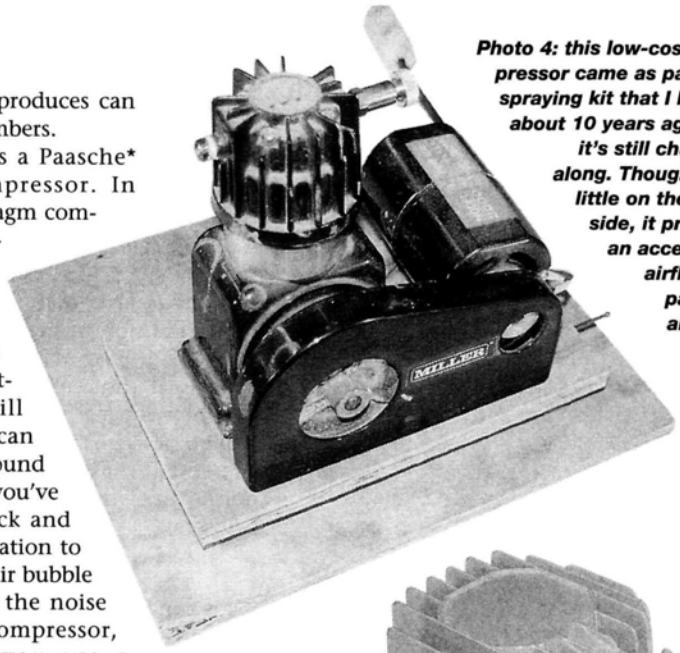


Photo 4: this low-cost compressor came as part of a spraying kit that I bought about 10 years ago, and it's still chugging along. Though it's a little on the noisy side, it provides an acceptable airflow for painting aircraft.

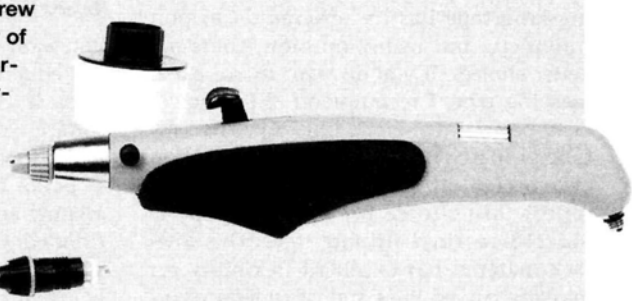
Photo 5: a diaphragm compressor like this one is a great investment. It provides a clean, regulated airflow and is very quiet. It has very few moving parts, so it's nearly maintenance-free.

AZTEC 470 DUAL-ACTION INTERNAL MIX AIRBRUSH

As Jim points out, dual-action internal-mix airbrushes provide much better control over paint application but typically involve a more complex clean-up procedure. I recently started using an Aztec 470 from the Testors Corp*. Aztec has supplied airbrushes to the commercial art community for some 40 years; Testors acquired the company and is making the equipment available to the modeling community.

Like most internal-mix brushes, the Aztec 470 provides very good control of paint volume and spread, and with a little practice, you can look like an expert.

The Aztec brush fits the hand a little differently from the more typical airbrush; I really like it, but that's a personal taste sort of thing. What's really significant about the Aztec brushes is their removable mix-head construction. Rather than having to completely disassemble this brush to clean it, you simply blow some solvent through it from a clean paint cup, unscrew the head and drop it into a jar of solvent. This sure makes airbrush use a lot more user-friendly.



Maybe more important is that if, for some reason, the head gets clogged (so far, this hasn't happened to me) it is easily replaced for about 10 bucks. Aztec also produces a color-coded line of heads for these airbrushes so you can quickly move from fine to coarse spray. The company even offers slightly coarser heads that were specially designed to spray the new acrylic paints. So, if you're in the market for an airbrush, be sure to give these brushes a look.

—Larry Marshall

MASKING MATERIALS AND TECHNIQUES

Even with the pinpoint control of an airbrush, there will be times when you need masking of some kind. I loosely group masks into two classes: those that produce a soft edge and those that produce a hard edge (photo 6).

Photo 6: here are some of the various masking materials you can use with an airbrush. Soft-edge masks can be made with cardboard or plastic sheet; hard-edge mask materials include various masking tapes, artists' frisket and so-called "Easy-Mask."

• **Soft-edge masks**. Some of the color boundaries on a scale model are more defined than even an airbrush can provide, and yet they aren't hard enough to require traditional masking. An example is the jagged, splinter camo on the upper surfaces of WW II Luftwaffe aircraft. Also, the model may need a feathered line, but it might be longer and straighter than your wandering hands are capable of replicating reliably. A typical example of this is the three-tone camo seen on mid-WW II U.S. Navy aircraft (see photo 7).

In these cases, I make a mask out of poster board, sheet styrene or another material. This mask can either be laid directly on the surface to produce a fairly hard edge or held farther away to produce a progressively softer effect.

• **Hard-edge masks**. There are a lot of options for masking hard edges. Good old masking tape has its adherents (no pun intended), but in my opinion, there are better choices. If you do want to use paper masking tape, I recommend 3M—a lower tack, professional-grade blue tape. Its low-tack property is very desirable (have you ever peeled off the paint along with the tape?). My choice for masking tape is 3M 218—a vinyl striping tape. This low-tack material has excellent flexibility for masking curved lines and provides a razor-sharp edge with almost no chance of bleeds.

For masking numbers, insignias and other graphics, I like to use artists' frisket. This sheet material can have graphics copied onto it with a photocopier, and it can be cut before it's applied or cut to shape on the airframe. Note that some aggressive paints like acrylic lacquer may attack the adhesive in the frisket; it's always a good idea to test the paint and mask for compatibility. My article in the February '97 issue of *Model Airplane News* covers the use of frisket in more detail.

Before departing the subject of masking materials, I'd like to touch on a handy masking product that can be found at your local paint store. It's variously called "Ready Mask" and "Easy Mask," and it's like a roll of "Post-It" note material. The material is thin brown paper with a low-tack adhesive along one edge. Though I don't use it for the actual masked edge, it's terrific for quickly masking off surrounding areas from overspray.

TYPES OF PAINT

It's beyond the scope of this article to consider each and every paint available to the R/C modeler, but a few general guidelines are in order. Because of their internal construction, airbrushes are best used with highly fluid paints that thin readily. This means that thick finishes like the latex paint favored by some giant-scalers may not be suitable. For optimum spraying results, nearly all paints have to be thinned to some extent, and I typically thin my paints anywhere from 25 to 50 percent, depending on the paint and the specific task. Generally,

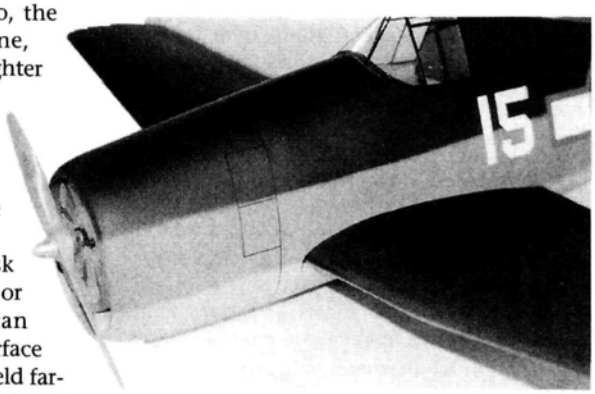


Photo 7: the long, straight, feathered line on the fuselage of this fighter was accomplished by holding a strip of cardboard about 1 inch from the surface. Similar effects can be achieved by using jagged pieces of cardboard to produce a "splinter" effect.

you want the paint to be thin enough for a test chip to draw out smoothly in a few seconds. If it's thick enough to retain a pebbly surface, you either need to add more thinner or to vary your spraying technique.

I like the spraying characteristics of enamel and urethane paints. They can be thinned with mild mineral spirits, and they stay wet long enough to draw out smoothly. Then they can be dried quickly with a heat gun in preparation for the next coat. Clean-up is simple, and the fumes aren't too objectionable. Because of the mild thinner, they work well with masking materials of all kinds. On the downside, some of these paints aren't fuelproof, so if you'll be flying with glow or gas power, a fuelproof clearcoat may have to be applied.

Other popular hobby finishes suitable for airbrushing include butyrate dope and epoxy finishes. When I flew primarily glow power, I really liked epoxy paint, and I've gotten excellent results by spraying it highly thinned. Of course, dope and epoxy both use rather aggressive thinners and produce dangerous fumes.

Another useful option is automotive-grade paint like acrylic lacquers. Be aware that some automotive paints have *extremely* toxic fumes, and even a regular respirator isn't sufficient protection. In these cases, a positive-pressure breathing apparatus is required.

A promising area of paint development is the new water-based paints coming on the market. These include water-based urethanes that cure to become fully fuelproof. I have no experience with these, but they're an interesting option. Water-based acrylics have a longer track record, but some of these lack the toughness desirable for an R/C model, and nearly all require a clearcoat.

Whichever paint you choose to use, be sure to read the label and observe all safety precautions. Even some water-based paints can produce potentially dangerous fumes, and you should always wear an approved respirator and have adequate ventilation.

PAINTING TECHNIQUE

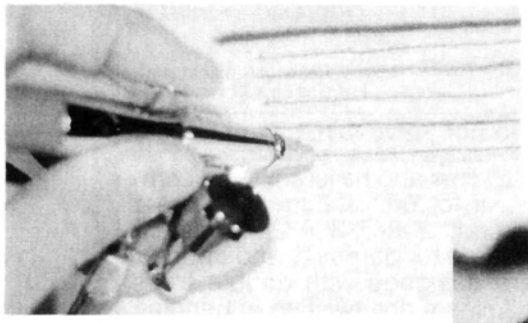
Technique is everything when painting a model aircraft. Because paint is both heavy and expensive, you want to use as little as possible to get a good finish. One of the most common mistakes I see inexperienced painters make with an airbrush is that they hold it too far from the surface. This not only wastes paint due to excessive overspray; it also tends to produce a gritty surface with poor adhesion because the paint is partially dry before it even hits the airframe. The proper technique varies from one type of paint to another, but in general, I like to stay about 6 inches from the surface. Work on producing nice, uniform, overlapping strokes that look smooth and wet. If the paint isn't wetting out, it won't draw out smoothly, and the surface will have an uneven, chalky appearance when you've finished. Though most people keep the brush farther from the surface for fear of getting runs, it seems that the opposite is more often a problem. For fine detail work like painting the speckles on the side of a Luftwaffe aircraft, I frequently work with the tip less than 1 inch from the work surface. As long as you carefully meter the paint flow, runs won't be a problem.

While we're on the subject: when painting an airplane, it's almost impossible to have too much light. Without bright light, it's impossible to tell whether you're getting the paint properly wetted out. My shop not only has banks of overhead fluorescent

fixtures, but I also have a pair of halogen lamps on tripod stands so that I can light the project from all directions.

PRACTICE, PRACTICE, PRACTICE

Using an airbrush is an arcane skill, and results improve dramatically with practice. Your latest scratch-built giant is *not* the ideal practice canvas. I recommend that you get a big sheet of butcher paper or some other plain white paper and start practicing. Some of the better airbrushes come with a manual that shows a range of practice exercises. Draw lots and lots of straight lines of various sizes. Note that with a double-action airbrush, you can draw incredibly narrow lines by bringing the brush tip very close to the surface (see photo 8). Being able to finely meter the paint flow allows you to avoid runs even when the tip is nearly touching the work surface. Work on getting the uniformity of the spray good enough to allow you to make a long, straight line of a constant width. When you've mastered that technique, work on curves and other shapes.



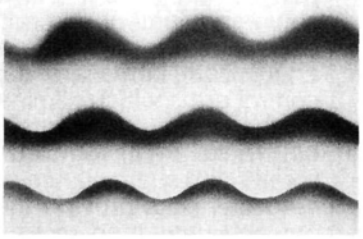


Photo 8 (above): there's no substitute for practice. This photo shows the fine lines that can be drawn with a good, double-action airbrush. Even when you're comfortable using your brush, it's a good idea to practice any freehand pattern on a sheet of paper before you apply color to your model. Photo 9 (right): this shows the range of blended edges that can be produced by varying the distance between a soft mask or stencil and the work surface. The wavy-edge plastic mask was placed on and then ½ inch and 1 inch from the surface to get progressively softer effects.

Cut some pieces of cardboard to experiment with soft masks. Photo 9 shows that by holding the masking card farther from the surface, you can get a range of effects; you can even produce shaded stencils or other special effects.

REPAIRS

An often overlooked use of an airbrush is for touching up minor repairs and hangar rash. Because a double-action brush can apply incredibly thin, controlled coats, you can carefully paint over a repair without disturbing the surrounding finish.

ADVANCED TECHNIQUES

An airbrush can also be used to produce weathering effects, but I recommend a very conservative approach to this sort of thing. Most of the airbrushed muzzle blast, exhaust stains, etc., that I've seen were grossly overdone. Understatement is the watchword here. I recommend you consult an expert resource like Dave Platt's new instructional video, "Scale Modeling's Black Art: Secrets of Weathering." You'll note that Dave, surely the master of weathering warbirds, makes very little use of an airbrush in the traditional sense.

CONCLUSION

Like any skill, learning to use an airbrush opens whole new worlds to the modeler. Projects that you might have shied away from in the past because of the complexity of the color scheme now just seem like an interesting challenge. So buy yourself an airbrush, get a big ole sheet of butcher paper, and have fun.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

Make Lightweight Spoked Wheels

by GORDON BRADT

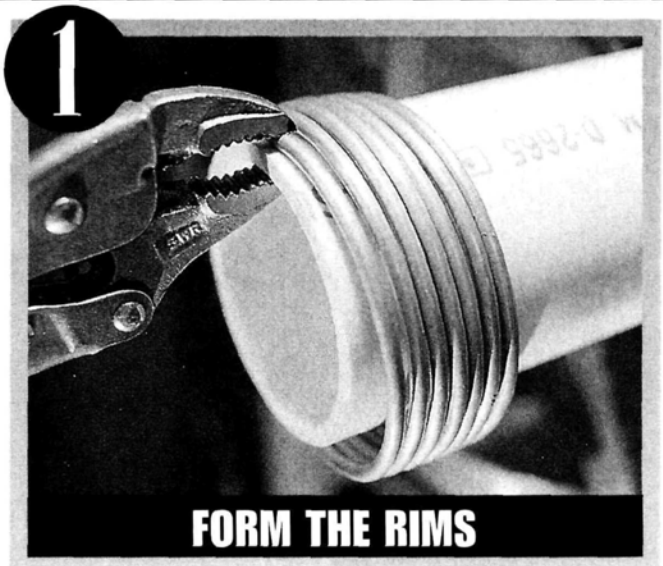
PHOTOS BY GORDON BRADT

A simple jig and monofilament line make it easy

Spoked wheels are not just for the old and slow flyers anymore! They can be as big as you want and yet still be quite rugged. Best of all, they are easy to build. What's the secret?—monofilament spokes, wire-coil rims and the use of my vanishing wheel jig.

Here's what you need:

- Six feet of 1/8-inch, soft-aluminum grounding wire (available at places like RadioShack), or two 36-inch sticks of 1/8-inch soft-aluminum welding rod (for small wheels, use 3/32-inch aluminum rod).
- About 4 inches of 1/8-inch-i.d. x 5/32-inch-o.d. brass tube (or larger, if your axles are larger than 1/8 inch in diameter).
- Four no. 8 brass washers.
- 25 feet of 25- to 50-pound-test monofilament fishing line.
- For the jig fixture, one 36-inch stick of 1/16-inch brass brazing rod.
- Tire material (that, we will talk about later).
- Thin CA, epoxy and silver spay paint.



1 FORM THE RIMS

For a mandrel, find a piece of PVC pipe that is about 3/16 inch smaller in diameter than the rims that you want to make. Clamp it in a vise, and then use some vise grips to clamp one end of the aluminum grounding wire about 1/4 inch in from the pipe's end. By hand, tightly wind the aluminum wire around the mandrel, making sure each coil is snug against the one before.

Wind eight coils; you'll use only six, but you will lose part of one coil as the wire springs back, you will scrap uneven ends, and you may need a spare in case of a goof. Now cut six good coils; if necessary, taper their ends with a file to accept a 3/16-inch length of the 1/8-inch-i.d. brass tube as a splice.

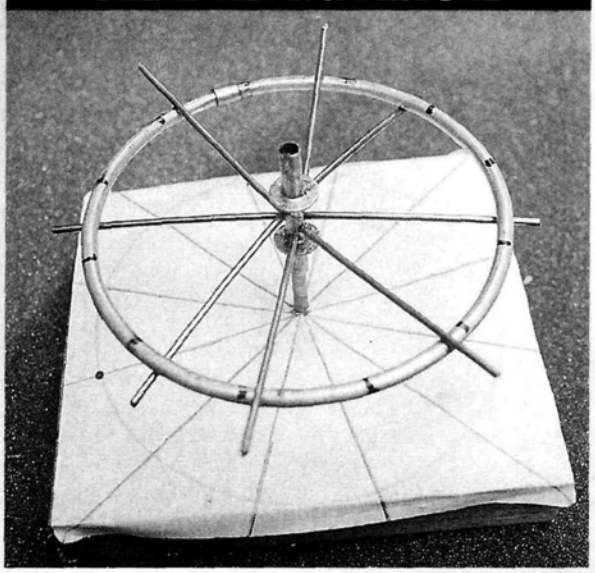
2 MAKE THE HUB TUBES

Cut two 1 1/4-inch lengths of the 1/8-inch-i.d. brass tube for the hubs, then cross-drill four 5/64-inch holes in each tube. Stagger these holes about every 20 degrees. The hole locations are not all that critical; just keep them toward the center of the tube and far enough away from each other to avoid having two holes become one oval hole.

3 MAKE THE JIG FIXTURE

Solder the brass washers about 3/8 inch in from the ends of the hub tube. To hold the hub tube, make the small fixture base shown in the photo. On the base, mark lines for half as many spokes as you will have on one side of the wheel. I like to build 48-spoke wheels, so I mark the fixture with 12 line positions like a clock face. For purists, I think the French used 40-spoke wheels and the British used 64 spokes.

Now lay each rim down on your fixture base, and use a felt-tip pen to make a mark at each of the 12 hour positions. For ready visibility when winding, extend the marks around and over to the other side of the coils.



• **The vanishing jig.** Cut eight lengths of the 1/16-inch brass welding wire for the jig. The pieces of wire should be about 1/4 inch longer than the diameter of the rims that you have made. Round the wires' ends to make handling them more comfortable. Insert three of these wires through the hub tube, position the rim hoop, and slightly bow the wires to hold the rim in position. The idea is to secure the rim concentrically inside the hub tube and perpendicular to it. Do this by turning the assembly and jockeying the rim and wires until you have minimized the run-out, or wobble. If you need to, add the fourth wire for more support. Also keep the jig wires away from the pen marks where you will wind the spokes. You can slightly bend the jig wires to get the rim to stay where you want it, but don't sweat it. This is not brain surgery. If you end up with 1/16-inch run-out, only your onboard pilot will notice. I don't have my jig wires all alternately overlapped or evenly spaced. Temporarily apply pressure to hold the rim in place, then apply CA to the joints where the jig wires cross the rim. When you have the rim where you want it, apply CA to the hub tube. Don't have anything stuck inside the end of the tube when you apply CA to that area, or it will be permanently stuck to the tube. If you want to support the tube, stick it in a hole, not over a pin.

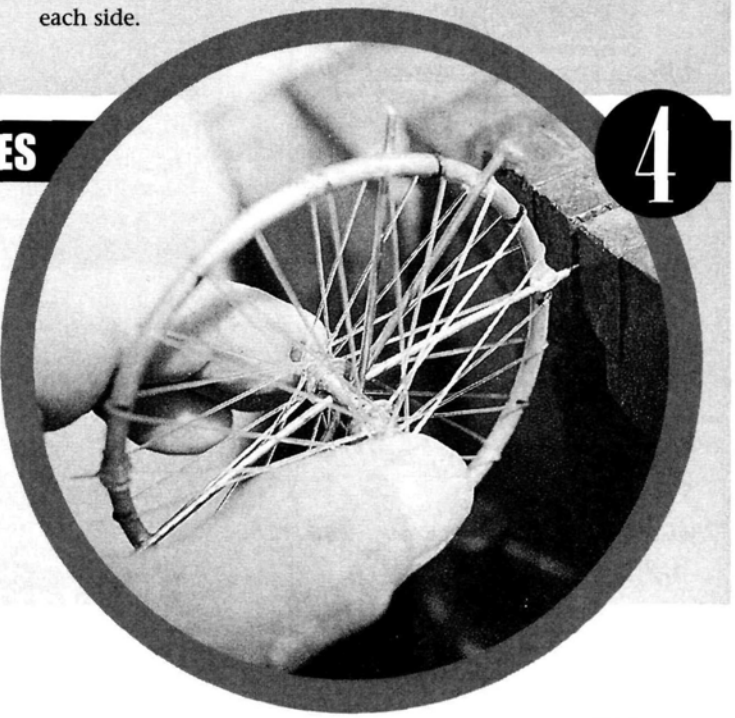
• **Winding the spokes.** This is the fun part. The winding takes only about a minute, so if you drop a stitch, or miss a mark, or the "spokes" aren't taut enough, just unwind and start over.

Start by tying the monofilament line with a single twisted loop at one of the marks on the rim (say, the 12-o'clock position), and put CA on the knot. Let the CA dry, then hold the assembly and start to wind the line down around the hub and back up to the 1-o'clock mark, over the top and back down around the hub on the other side and on up to the next mark (2 o'clock), and so on. Be sure to wind around the hub in a U-shape; don't cross the line over itself. Keep it taut while you wind by using one of your fingers to clamp it to the rim. When you get back around to 12 o'clock, cinch the line around a few times and CA it into place. Check and adjust the line to be sure it crosses the rim at each hour mark, and then CA all the contact points.

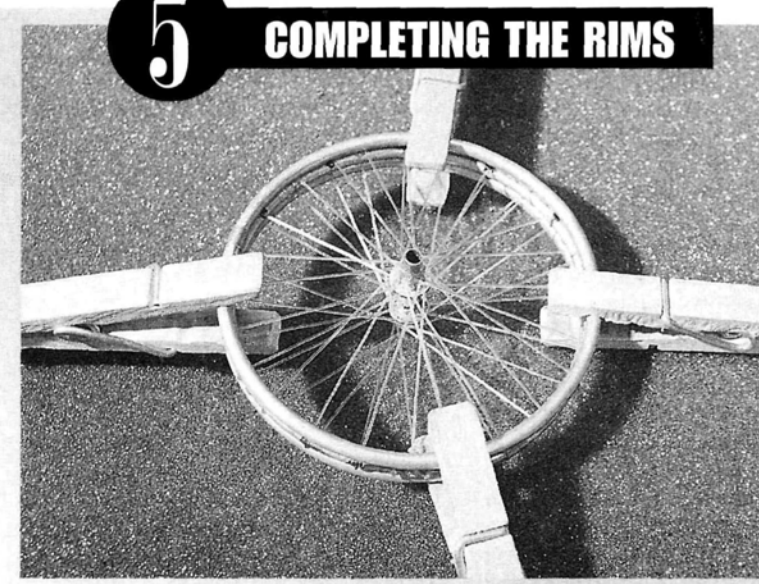
Now look to see whether any of the fixture wires are in the way of the half-hour positions (halfway between the contact points). If any are, gently break the wires free at the rim, slightly bend them out of the way, and clean off the dried CA. Now simply repeat the winding sequence, but go halfway between the hour marks. I don't bother to mark these half-hour points; just eyeball them. CA all the half-hour-mark contact points and where the line loops around the hub tube on each side.

4 THE JIG VANISHES

Now you have an assembly that should look like the one in this picture. First, break the fixture wires loose at each point where they cross the rim hoop. Then, as in the picture, clamp one end of a jig wire in a vise, grasp the hub tube between your fingers, and twist it to break the CA joint at the hub tube. Twist and pull to extract the jig wire from the assembly. Hold only the hub tube while doing this—not the rim. Repeat this with the other jig wires and clean the CA off the rim and the hub tube. Be careful not to cut any of the spokes. Clean out the insides of the axles with a drill bit, but use caution here: if the drill bit seizes, you might tear out your spokes.

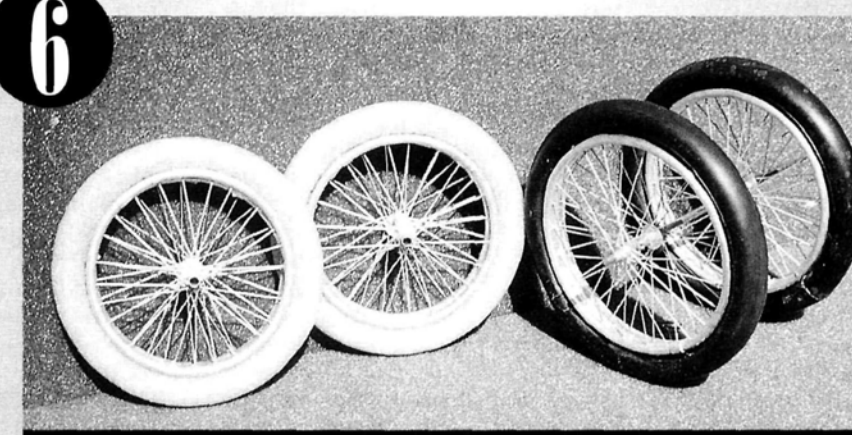


5 COMPLETING THE RIMS



Position the other hoops on each side, jockey them around till you get the best fit, and clamp the rim and hoops together. Check to be sure the outside hoops are even with the center rim all around. Now run a thin coat of epoxy all the way around the outside, except at the clamp positions. When the epoxy sets, remove the clamps and epoxy the rest. Spray-paint the wheel lightly with silver, but not too much! You don't want your spokes to look as if they're made of scale barbed wire.

6 NOW FOR THE TIRES



The picture shows two versions: the bigger wheels use ½-inch-o.d., 1/16-inch-wall, black rubber tubing. I cut and lightly sand the ends to get a tight, clean joint; CA works great on this. Then a little epoxy works best to mount the tire on the rim. The finished, ⅜-inch-diameter wheels each weigh about 1 ounce. If your plane is heavier than 4 or 5 pounds, you may want to go with thicker, ⅛-inch-wall rubber tube tires.

For lighter wheels, I use the Polyolefin foam "backer rod" used in caulking applications. It comes in diameters of ⅜ inch to ⅞ inch and is extremely light—only a few grams per tire. Using it alone as a tire, however, presents some problems: some brands are of such a light density that they can't be looped into a circle without folding; so you must find the dense stuff. Also, it is gray and just sloughs off paint and dye. I have found, however, that the rubber coating that tool handles are dipped in can be troweled on as an outside coat. If you can't find black, go ahead with red or blue and then color it with a black, felt-tip marker. Also, CA won't work to join this stuff; you must use epoxy. The smaller wheels in the picture show these foam tires without the rubberized coating. Complete with tires, these wheels each weigh less than 1 ounce and have withstood many a hard landing.

Build-along: Hirobo Shuttle RG

If you've been following along, you'll know that last time, I promised we'd start a Hirobo* Shuttle RG "build-along" to help show some common heli building techniques; so let's get started.

First things first. Read the instruction manual. This very important first step will familiarize you with the parts and building sequences that lie ahead and will help you understand how everything will fit together. Note all of the safety precautions and the special tools that might be needed. Most manuals use warning or caution symbols to bring attention to critical steps, for instance, where thread-lock is to be used and where you need to apply grease during assembly. Remember, if they are not built and flown correctly, helicopters can cause serious injury and property damage. If you're new to helis, please find experienced help; this will save a lot of time and frustration and help you avoid making mistakes.

When starting a new heli project, first break in your engine. Run the engine on a test stand with an airplane prop attached. Set the idle and top end, and run at least 10 tanks of fuel through it. When it's in your heli, it will be easier to start, and the idle settings will be very close to perfect.

Before I build a new heli, I like to have all the necessary components on hand. This makes the project flow along more quickly, and I don't have to wait for mail-order deliveries or make a trip to my local hobby emporium. These vital components include the engine, muffler, radio, five servos, gyro and main- and tail-rotor blades. You'll also need Loctite* 242 thread-locker (blue compound); use it on all metal-to-metal screws. Some kits include a small tube of 242, but if yours doesn't, you can get it at any auto-parts store. I also make sure that the radio battery is fully charged. Be sure to use at least a 1000mAh receiver pack—preferably larger. For helicopter receiver packs, more is better because we need to power five servos and a gyro that are always moving, and this makes heavy demands on the battery.

BREAK IN THE ENGINE

Before starting construction, bench-run the engine and break it in. If I can, I also use the muffler that I'll use on the heli.

Why should you bench-run the engine?—for several reasons: first, there is nothing more frustrating than trying to get a brand-new engine that you are unfamiliar with to run. In an airplane, you can adjust the needle valve while running the engine at full speed. You can't do that with the heli because it must be flying for the engine to be at full throttle. By running several tanks of fuel through the engine, you can make the high-end and idle adjustments. After that first start-up, you'll know the engine is very close to having the proper needle settings, and you'll have one less thing to worry about.

With most sport-type airplanes, the engine is out in the breeze and therefore easy to adjust. In a helicopter, the engine is encased in a cooling shroud that directs airflow over it. A heli engine is more difficult to work on and typically runs hotter than an airplane engine. Bench-running allows the piston, sleeve and other moving parts to seat and wear in properly. The engine is the heart of the machine; if it doesn't run properly, your heli will be more difficult to trim and fly. Always follow the manufacturer's instructions for proper break-in.

Now that the engine has been broken in, let's balance the cooling fan and install it along with the clutch.

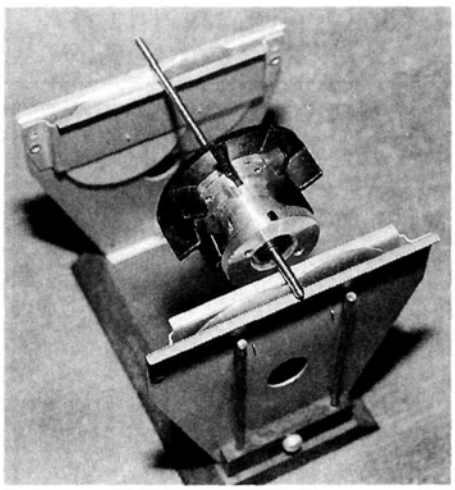
GET BALANCED

Last time, I said that a balancer is one of the most important tools for building a helicopter. If you're serious about helis, please either buy one or borrow one from a flying buddy. It's a small investment that pays big dividends.

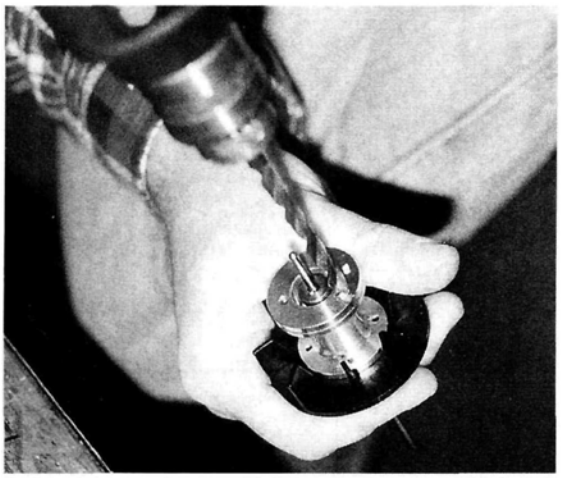
OK; first mount the fan on the balancer as you would a propeller. Lightly spin the fan, and when it stops, make a mark at the 12-o'clock position. (I use a Sharpie pen for this.) Having made this mark, lightly spin the fan again and note where the mark is when the fan stops spinning. Do this several times. Does the fan stop in the same place each time, or does it always stop in a different position? If it always stops in the same spot (with the mark at or near 12 o'clock), the marked spot is the light side of the fan and material must be removed 180 degrees from that mark. If the fan stops randomly, it's OK as is.

Most fans require some work, and there are several places from which you can remove material. You can drill dimples on the face of the hub to which the clutch is mounted (only if the dimple will not be near the screw holes for the clutch) or on the side of the hub. You may also remove material from between the fan blades. I don't recommend that you remove material from the blades themselves; this could weaken them, and one could break off while the engine is running.

To remove material, I use a ¼-inch drill bit to make a shallow dimple opposite the mark. Remove only a little at a time, then put the fan back on the balancer, spin it again and see where the mark ends up. Repeat as necessary until the fan stops at random positions. This might sound like a long process, but it takes only a few



Use a High Point* balancer to check your fan assembly and mark the 12 o'clock (light side) position.



Left: when you know which is the fan assembly's light side, remove material from the heavy side (180 degrees from the mark) by drilling dimples in the flat surface. Check the fan again on your balancer and remove as much material as necessary to bring the fan into balance. Use a 1/4-inch drill bit, and do not drill too deeply. Right: this shows the clutch-bell housing with dimples drilled in its side surface. Again, remove as much material as you need to, but do not drill all the way through the surface.

minutes. While you have the balancer out, you can also balance the clutch-bell housing. Do this in the same way as you balanced the fan. You can place dimples on the outside surface of the housing or on the top. Just be sure that you do not drill all the way through the housing. Several dimples can be grouped, if necessary, to balance the housing. With the fan assembly balanced, you can now attach it to your already broken-in engine.

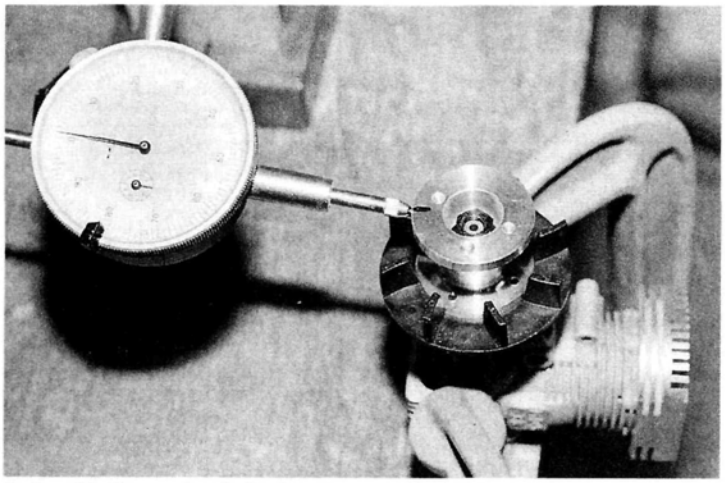
CHECKING RUN-OUT

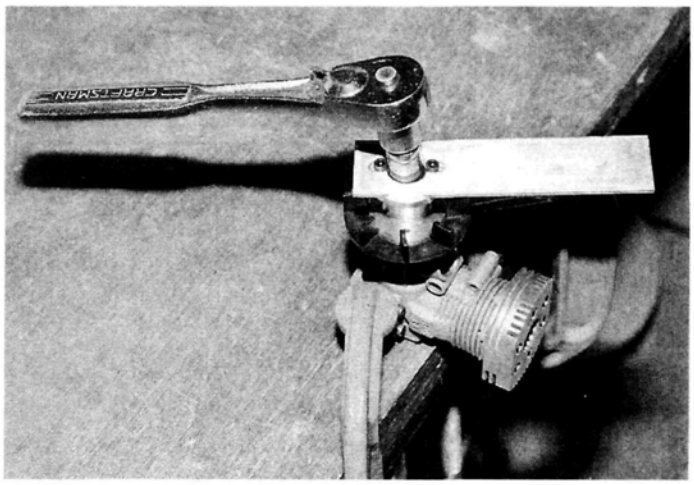
This is where a dial indicator comes into play, as we want the fan to have a run-out (out-of-true condition) of 0.002 inch or less. Remember that the fan and clutch assembly are turning at crankshaft speed. If the engine turns at 12,000rpm, so do the fan and clutch. Most cooling fans use tapered collets to center the fan on the engine crankshaft. The Shuttle RG has a tapered collet on the base of the fan and a stepped washer under the prop nut. This system works well to center the fan.

Start by removing the glow plug, as you want the engine to turn over easily. Mount the fan loosely on the engine using the tapered collets and the prop nut. Do not tighten them yet. Next, mount the engine on the engine mount supplied with the kit, then clamp the mount to a solid surface so it doesn't move. You can mount the engine vertical or horizontal, whichever is more convenient. Now position the dial indicator's pointer on the lip of the fan hub. Rotate the fan to find the high spot, and mark it using a Sharpie. Next, rotate the fan while watching the dial; if the run-out is 0.002 inch or less, go buy some lottery tickets because you're very lucky! If the run-out is greater than 0.002 inch, loosen the prop nut, rotate the fan 180 degrees, repeat the process and check the run-out again. If the run-out is less than it was before, you're moving in the right direction; if it's more, return the fan to its original position and rotate it again, but only 90 degrees this time. Recheck the run-out. Keep doing this until the fan's run-out comes in.

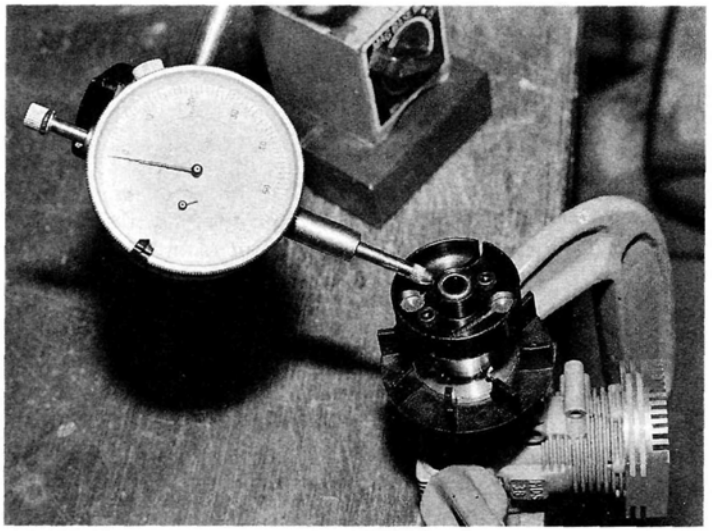
Once the run-out is 0.002 inch or less, tighten the prop nut a little at a time (I use a thin-wall socket and ratchet) and check run-out after each tightening. If you apply too much torque, the fan will move. If everything is still OK, tighten the nut a little more and check again. Do this several times. Once the prop nut is fairly tight, unclamp the engine and insert a wooden dowel into it to jam the crankshaft and prevent the crankshaft from rotating as you tighten the prop nut. Some kits include a special fan wrench that you bolt to the fan hub. If you use a wooden dowel, remove the backplate and place the dowel between the housing and the crankshaft to jam it, or remove the carburetor and insert the dowel through the carb opening. Remember, you don't want the nut to loosen while you're starting the engine. If it does, you will have to all this again. If you like, use a little blue Loctite on the prop nut for extra security. Also, don't insert a screwdriver into the exhaust port to jam the crankshaft! You'll damage your engine.

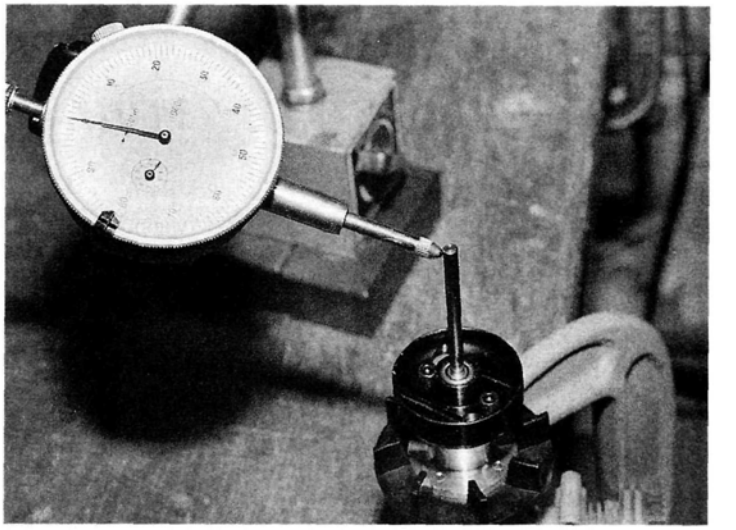
I don't recommend that you use a piston-locking tool to jam the crankshaft. These tools screw into the glow-plug hole, and as you tighten the prop nut, the piston is pushed against the end of the tool. I have seen people using this tool punch a hole through the top of piston. A wooden dowel is a much safer way to prevent the crankshaft from rotating.





Left: with the engine bolted to its mount and clamped to your workbench, loosely attach the balanced fan assembly to it, and check the fan's run-out with a dial indicator. You're looking for less than 0.002 inch of run-out. Right: when the run-out is less than 0.002 inch, slowly tighten the prop nut to secure the fan to the engine. Tighten a little at a time and recheck the run-out until the nut is completely tightened down. Here, I am using a fan wrench and a ratchet and socket to tighten the prop nut.





Left: with the fan tightly in place, attach the clutch loosely and check its run-out. Again look for 0.002 inch or less run-out. Right: if your heli has a starter shaft, you must also check its run-out. If it's more than 0.002 inch, gently push, or "tweak," the shaft until the run-out comes in.

MOUNT THE CLUTCH ON THE FAN

Loosely mount the clutch on the fan, and clamp the engine and mount to a solid surface as you did before. If your clutch has the starter shaft pressed into it, place the dial indicator's pointer on the base of the shaft. Some clutches, e.g., the one on the Shuttle RG, have a separate starter shaft, so you place the pointer on the outer diameter of the housing in which the shaft seats. As you did previously with the fan, find the high spot, mark it, then see what the run-out is. Again, you want less than 0.002-inch run-out. If the run-out is greater, remove the clutch, rotate it 180 degrees and check again. It will either be less (better) or more (worse). If it's less, gently loosen the clutch bolts and ever so slightly shift the clutch away from the high spot and then retighten the bolts. Check the run-out once again. Keep doing this until the run-out comes in. When everything is good, remove only one bolt and put a little Loctite 242 on it. Replace the bolt, tighten it, and then do the same to the other bolt. Check the run-out one more time to make sure that nothing has shifted.

For the Shuttle RG, once the clutch run-out is OK, you've finished. If your clutch has a pressed-in starter shaft, you must now use the dial indicator on the tip of the shaft. The same 0.002-inch tolerance is required. If the run-out is more than 0.002 inch, slide a brass tube over the shaft and gently tweak (push) the shaft toward the low side of the tip. Check again and adjust as necessary. To give you some idea of how easy it is to do all of this, my RG took approximately 30 minutes to do. The fan balancing took about 13 minutes; checking the run-out took about 10 minutes. At first, the fan had a 0.004-inch run-out. After I had moved things around a few times, the run-out was 0.001 inch. The clutch was also at 0.004 inch; after I had rotated it 180 degrees, it, too, was at 0.001 inch—not bad for a few minutes' effort.

For all this work, you'll end up with a smooth running power system that's ready to go into the chassis. Remember, this is my technique, and it's by no means the only way of doing things. If you have a better or easier way, let me know, and I'll share it with our readers.

Next time, we'll start building the chassis. Remember: fly safely and with purpose.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ✚

VIBRATION—A CASE OF THE SHAKES?

Helicopters have many rotating parts that can be sources of vibration. It's very important to learn to interpret what the heli is saying to you while it is running. Knowing where to look to correct any serious vibration or out-of-balance condition is the first step to fixing it.

The type of vibration will tell you where to look; for example, if the tips of the horizontal tail fin are buzzing, chances are the tail rotor is out of balance or the output shaft is bent.

Other indicators to look for:

- **Is the tail boom bouncing up and down?**
- **Is the fuel foaming or sloshing?**
- **Is the canopy shaking? (Is it the nose, or is it the rear edges of the canopy?)**
- **Are the landing skids shaking also?**

Each of these indicators can lead you to the source of the vibration.

- **Low-frequency vibration** usually means a problem with the main-rotor system. The main blades could be out of track or out of balance. If the heli had a small "Oops," the main shaft may be bent slightly. Replacing the shaft could solve the problem.

- **High-frequency vibration** usually centers on the engine, the cooling fan and the starter shaft or the tail rotor. Because these spin at higher rpm than the main rotor, their vibration can be more damaging and should be fixed right away. The importance of reducing vibration can't be overstated. A smooth running heli will last a long time and give many hours of trouble-free operation. If you aren't sure what to look for or how to fix it, get some experienced help.

Making your own laser-cut kits

Over the last few months, we've discussed computer-aided-design (CAD) at length. We've looked at various ways of transposing an existing 3-view into the CAD environment and then using the 3-view as a basis for a lightweight and functional airframe. Using CAD to produce a plan is useful enough in its own right, but having the design in digital format opens up a number of other possibilities. Perhaps the most intriguing of these is using the CAD outlines of the formers, ribs and other parts as a basis for a laser-cut "kit" of your design. Just think: instead of spending hours cutting out all the wing ribs, formers and other parts, you could email a few DXF files to a laser cutting supplier and a few days later have a box of parts delivered to your front door. Furthermore, if you have ambitions of marketing a kit of your masterpiece, laser cutting is a quick and easy way to produce perfectly uniform parts. Unlike die- or machine cutting, there are no tooling costs, setup costs are minimal, revisions are simple, and the tooling never wears out or goes out of tolerance. Few methods of fabricating parts have the repeatability and accuracy of laser cutting.

My interest in laser cutting awakened when I was persuaded to offer kits for some of my electric warbird designs. I didn't really intend this to become a major product line (I mostly like to build models for *me*), and I had no interest in incurring the expense of having die-cutting dies built. Laser cutting seemed the perfect alternative, and that's pretty much how it turned out.

So this month's column is a general discussion of the steps involved in preparing laser cutting files and ordering parts from your chosen supplier. I include tips on some of the potential pitfalls, and I also list laser-cutting suppliers who work with hobbyists.

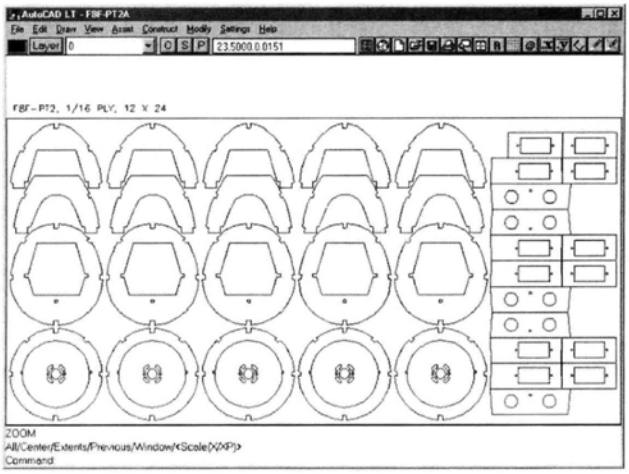


Figure 1. This view shows how parts have been arranged to make optimum use of a sheet of plywood. Note that wherever possible, parts share edges; this saves laser cutting time and material. No part should touch the edge of the rectangle that defines the size of the plywood sheet.

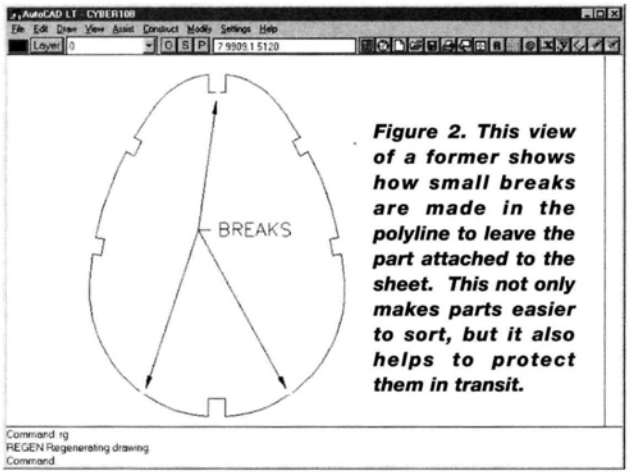


Figure 2. This view of a former shows how small breaks are made in the polyline to leave the part attached to the sheet. This not only makes parts easier to sort, but it also helps to protect them in transit.

PREPARATION

The most important aspect of getting parts ready for laser-cutting is to do the prep work correctly. If you end up having to pay the supplier to correct your sloppy CAD work or have to order replacement parts because the first set was incorrectly drawn, the cost rapidly becomes prohibitive.

Generally, the laser-cutting shop expects you to provide individual files for each sheet of stock from which it's supposed to cut parts. I do this by drawing a rectangle the size of the sheet of material, and then I arrange my parts in the rectangle to optimize material use. Make sure you keep grain direction in mind, and don't place the parts too close to the edge (I try not to get closer than ⅛ inch if I can help it).

COST-OPTIMIZING YOUR DESIGN

There are a few simple tips that will help your files to cut faster. Remember, you're being charged for machine time, so the faster your files cut, the happier the operator is and the lower is your cost. The best tip is that, whenever possible, parts should share edges. This not only minimizes waste, but it also effectively gives you two cutting passes for the price of one. Figure 1 illustrates this.

A less obvious factor that can slow down the laser is the number of line segments in an entity. For instance, some airfoil-generation programs default to a resolution that is far finer than necessary, with the result that a wing rib may be made up of a few thousand line segments, when 50 or 100 would be just fine. Some foil-generation programs allow you to change the resolution before you export the ribs to your CAD program, but for others, you might have to trace over the ribs in the CAD environment to reduce the number of line segments. For a one-off design, this may not be worth the effort, but if you're putting together a couple of hundred kits, that extra $5 a kit starts to look pretty significant.

OTHER TIPS

A few other tips can make your life easier: for instance, when I first started kitting my designs, I left the outlines for the formers and ribs solid so that they'd fall free of the sheet stock. After a while, I got very tired of sorting parts into stacks so that I could bag them for packing, and I realized my life would be a lot simpler if I left small breaks in the outlines so that the parts would stay in the sheet. That way, I could just throw a few sheets of wood into a bag, heat-seal it and go on to the next step. This also makes the builder's life easier in that he doesn't have to sort through the parts and match them up to the plan to see which part goes where.

Figure 2 shows an example of formers held into the sheet by breaks in the polyline. In my experience, a 0.040-inch break is about the smallest that will hold the part in place (remember the kerf cut by the laser ends up making the actual break on the wood about 0.015 inch smaller). A break of 0.050 inch or even 0.060 inch might be better for larger parts.

ACCEPTABLE FILE FORMATS

Talk with your laser cutting supplier about their preferred file formats. Generally, they can import a DXF file directly into the computer that controls the laser cutter, but there may be exceptions. Of course, this opens another can of worms in that DXF files are not a perfect file-export method. It isn't uncommon for there to be errors when the file is imported from one CAD system to another, and unfortunately, this holds true for laser cutting programs as well (Figure 3 shows some examples of common errors). In fortunate cases, import errors are so large as to be obvious to the laser operator, but they can be more subtle and unlikely to be detected. In one case, my formers showed up cut perfectly to shape, but one former was neatly cut in half by an extraneous diagonal line that popped up during the file import. The operator was curious why I wanted a split former, but didn't have time to call and ask. So I ended up having to get the parts recut. Problems like this can be time consuming and frustrating, so here are a few things that you can do to stack the odds in your favor:

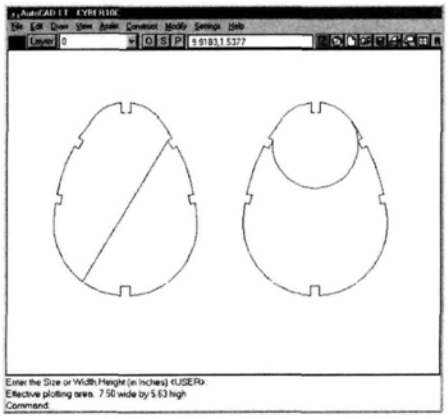


Figure 3. Here are a couple of examples of DXF import errors. In the left view, the former is cut in half by an extraneous diagonal line, while in the right view, an arc has been misinterpreted. Both will result in an unusable part.

• **Use a single drawing layer.** A common source of problems with file imports is the multiple drawing layers that most CAD programs support. When I create laser cutting files, I save everything to Layer 0, and this seems to help avoid problems.

• **Explode all polylines.** In my day job, CAD files have to have a single, unbroken polyline for our machinery to be able to complete a cut, so I've always had a mania about observing this requirement. It turns out that this is *not* the case for most laser cutting machines, and since edited polylines are another potential source of trouble, I explode all the polylines in my file before I export the DXF file. Depending on the software, this may or may not make files take a little longer to cut, so ask your particular supplier.

• **Show stock sizes on the file.** Please be charitable to your laser cutting operator and remember that he's working with literally hundreds of different orders, and can't be expected to remember what type of stock your parts require. As shown in Figure 1, include a text line showing the type, thickness and size of sheet stock needed for each file.

• **The "belt and suspenders" approach.** As final insurance against file-import errors, I print out hard copies of each CAD file to mail or fax to the laser cutting supplier. This gives the operator a visual check for glitches in the DXF import. Remember, he has no way of knowing what your parts are even *supposed* to look like unless you show him.

CONCLUSIONS

I love building, but cutting out the parts to make up a kit is not my favorite part of the process. While it's ideal for small- to medium-volume kit production, laser cutting is a viable option even for "one-off" designs and prototypes, though the setup charges of some suppliers can prevent this from being cost-effective. The beauty of this cutting method is that elaborate shapes that would be extremely tedious to cut by hand or with a scroll saw are the work of an instant for the laser. Jig holes, crutch slots, alignment tabs and all sorts of assembly aids can be added during the design process, making the finished product that much easier to assemble. And there's no denying that bringing a kit of your own design to market is a satisfying experience. So what are you waiting for?

Supplier	Requirements	Location	Phone	Email
Sig Mfg.	Multi-kit requirement	Montezuma, IA	(515) 623-5154	flysig@netins.net
Laser Arts Co.	No minimum order	Colorado Springs, CO	(719) 576-7379	laserartco@aol.com
Hobby Hangar	Multi-kit requirement	Hebron, KY	(606) 334-4331	hobbyhangar@earthlink.net

This table shows contact information for just a few companies that laser cut wood for model kits. It is in no way intended to be all inclusive; there are many other laser-cutting operations out there, and a Web search or a look through the local "Yellow Pages" can be very productive.

by Don Edberg

Flight Conditions

For several columns, we've talked about programmable mixers. While I haven't finished discussing them yet, I think it's time to take a breather and look at some other unique features of computer radios. This month, I look at "flight conditions."

To understand how flight conditions are helpful, it's worth considering a simple example: let's pretend you have a scale model. At low speeds (like at takeoff and landing), it happens to be very sluggish and requires flaps to take off without using too much of the runway. Its long wing needs to have rudder used in turns to make them more coordinated, or it has a tendency to stall and spin—not desirable at low altitudes, especially when taking off or landing. And it helps to have a bit of rudder offset to compensate for the effects of engine torque. To make sure the engine doesn't quit during this critical time, you want glow heat on for takeoff. These requirements are listed under "Takeoff condition" in the table.

For high-speed cruise, your scale ship becomes a totally different animal: the higher airspeed makes roll and pitch inputs produce very crisp and rapid responses, and no rudder coordination is needed. Its wing is efficient, so flaps are not needed. A little elevator trim is needed to compensate for the trim change when the landing gear are retracted, and you want to remove glow heat. These requirements are also listed in the table, in the "Cruise condition" column.

The widely varying requirements for the two different flight regimes of the scale model make it almost sound as if we're talking about two different airplanes—right? In a sense we are, but that's where we take advantage of the idea of *flight conditions*.

Flight conditions are a unique concept referring to the idea that the R/C system user may select a predetermined group of different aircraft specifications *as a single entity*. For the scale model example, we would want two separate configurations: one for takeoff and one for cruising. Each configuration would include control neutral positions, specific servo travels, response curves (i.e. exponential or no expo), a set of mixers with certain functions and so on. *The key is that each and every one of these sets could have an entirely different group of settings.*

Flight conditions are commonly activated by a specified switch. The owner selects which switch (and direction) are to be used to turn them on and off. It makes sense to define two conditions—one that might be called "takeoff" and one called "cruise." You might want to allocate them so that the retract switch position corresponding to "gear up" told your transmitter to be in the cruise mode, while the "gear down" position would activated the landing mode.

Some systems also allow you to use what's called "stick-switching," in which the flight condition gets turned on and off not by a switch but by a stick or control moving past a specified position—for example, moving the rudder stick past (say) one-half travel might be used to turn on a flight condition for knife-edge flying.

We've used the term *Flight Conditions* for this idea, but that's what Futaba* calls it. Other manufacturers have their own names for it. JR* refers to it as *Flight Mode Control*, and Airtronics* calls it the *Alternate* function. These names all describe the same topic: a group of things that happen all at once.

So, one way to understand the concept of flight conditions is to make believe that you can set up a model to have two or more unique sets of neutrals, servo travels, linear or expo response, selected program mixers, and so on, that may be chosen by a single action by the pilot—flipping a switch or moving a control. The alternative, which you'd have to do on a radio without flight conditions, would be to flip a handful of switches as simultaneously as possible: a dual rate switch, an expo switch, a neutral offset switch and one or more programmable mixer switches. For a complex model, you can see that flight conditions are a more rational way of keeping track of all the changes.

• **Delays.** Suppose now that you've set up the scale model as mentioned earlier; many of the servos have different neutral positions between the two conditions. When you flip the condition switch, the servos will "snap" to their new positions right away. True, but that's not very scale-like, and it might cause some momentary trim changes that would make the plane fly less smoothly. For this reason, the radio manufacturers provide *delays* to slow the servo's transit between the two extremes. Usually, you can select from no delay up to a 5-second or so delay. This helps to prevent the sudden trim changes that can occur and, even better, it makes the plane look really cool! Imagine that your model is flying and you change from takeoff to cruise mode; the gear slowly retract while, at the same time, the flaps slowly retract into the wing and the elevator trim position slowly changes.

• **Condition naming.** One other aspect of flight condition use can cause confusion. How do you keep track of which is which? Well, like any other system, it depends on the user doing a bit of bookkeeping. You can assign a name to the flight condition, just as you can name the model memory for a given model. The flight-condition name may be shorter than the model's name, but it doesn't

Example flight conditions (groups of settings) for a scale plane

CONTROL	TAKEOFF CONDITION	CRUISE CONDITION
Ailerons	High rate (sluggish)	Low rate, expo (sensitive)
Elevator	High rate (sluggish)	Low rate, expo (sensitive)
Rudder	Coupled to ailerons to reduce yawing	Uncoupled
Flaps	Down (say 20 degrees)	Neutral
Elevator trim	Compensates for flaps/gear pitch trim	No trim at cruise
Rudder trim	Compensates for engine side thrust	No trim needed
Landing gear	Down	Retracted
Aux. (glow plug)	On	Off

matter that much as long as you use it. Futaba's 9Z allows five characters for the flight condition. For my example above, I'd use "NORML" (for the normal or cruise condition) and something like "TKOFF" for takeoff. The flight condition letters are displayed according to the position of the flight-condition control, so you always know what condition you're in. This is important; you don't want to change a bunch of settings only to find you've done it in the wrong flight condition!

• **How do I set up another flight condition?** You shouldn't set up alternate flight conditions until you have your default condition settings chosen so that the model is trimmed properly and flying as you like it. The reason for this is that you want to start with the existing conditions, which you know work well. It's almost always easier to duplicate the default settings into an alternate and make changes. You'll then be able to modify the existing dual rates, servo travels, mixers, and so on instead of entering them from scratch each time.

• **Which radios have flight conditions?** JR have a flight-mode control feature in their PCM 10SXII. The user can select from up to five sets of flight configurations associated with one model. The Futaba 9Z system provides up to eight flight modes for a single model memory, and the basic Airtronics Stylus allows users to switch between two modes with its Alternate function (with the optional plug-in function cards, you get more than two flight modes).

• **What if I can't afford one of these expensive radios?** The top-end radios mentioned above provide what you might call "full-function" flight modes. However, many computer radios provide *some* of the features that could be used to mimic the flight modes without the cost; you just have to do more work to get things to happen. For example, most helicopter radios provide settings for normal, idle-up, throttle hold and switchable offsets (which are nothing more than changing the neutral positions of the servos), etc.; but these are not really flight conditions in the sense described above: the heli conditions only switch between different rotor- and engine-response curves. If these features are combined with switching dual rates and mixing, you have a "poor man's" flight-mode change. Similarly, radios with glider functions usually provide different settings for launching and speed tasks, so again, you have an approximation of flight modes.

You don't have to buy a high-end radio to switch between many of the flight-mode functions, but you may not be able to put them all on a single activation switch: you're not able to change the servo travel *and* turn expo on or off *and* switch neutrals *and* select different sets of programmable mixers by moving a single switch. That's why you pay the big bucks for a top-end system!

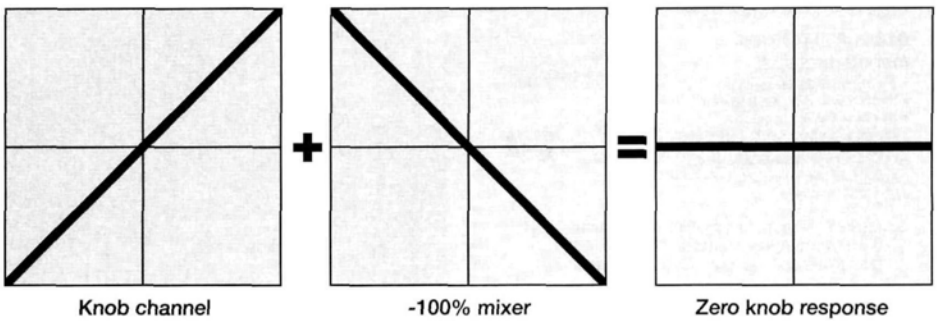


Figure 1. You can disable a knob by turning on a mixer from the knob channel to itself with -100 percent mixing settings.

DISABLING OR "TURNING OFF" A KNOB

Last time, we talked about how to set up toggle switches to command a certain flap deflection. Many computer radios use a knob for the flap control, so if you want to use switched flaps, you have to be sure not to move the knob to keep the flaps fixed. I mentioned that you can "turn off" or disable a control knob so that you can use the receiver channel corresponding to the knob for other things without worrying about what will happen if you accidentally turn (or bump) the knob. Here's how:

• You need to have a spare programmable mixer available.

• Activate the spare mixer, set the master channel to be the knob channel, and also set the slavė to be the knob channel.

• Next, assign mixing values of -100 percent, -100 percent to both sides of the mixer. The -100 percent mixing value cancels out the regular travel commanded by the knob, as shown in Figure 1. Therefore, nothing happens when you turn the knob.

Of course, you can also mechanically disable a knob. Usually, you can remove the knob by firmly lifting it straight up along its axis, and it's much harder to turn with no knob on top. If you prefer, you can lightly CA a short piece of brass tube around the pot to prevent you from touching it; you can always pop it loose later if you want to remove it.

Remember, if you want to write me, send your self-addressed, stamped envelope to Don Edberg, 4922-A Rochelle Ave., Irvine, CA 92604; or email me at <dynamic3@flash.net>, or look for an answer on my Web page <http:www.flash.net/~dynamic3/>. I get lots of mail, so please be patient!

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

Tidbits from trailer hitches to hatch latches

As I look back on my involvement with building and flying scale R/C models, I find that my enthusiasm has not waned. If anything, my interests have grown and diversified to include areas I might not have fully understood or even accepted in earlier years. Much of this comes from personal experience and interaction with other modelers. I feel privileged to write "Scale Techniques" because it allows me to share information, answer readers' questions, show some modeling techniques and air important issues that relate to our scale community. I encourage those of you who have questions or suggestions for "Scale Techniques" to write to me care of *Model Airplane News*, or you can send me email at Leu@eclipse.net. During the five years I've been writing, we truly have only scratched the surface of this thing called scale.

READER RESPONSE

I received a nice letter and some photos from Charles Brainard of Pawcatuck, CT, regarding his F4U-1 Corsair. Charles tried out my technique on replicating fabric-covered control surfaces with tape and primer, and he writes: "I used the technique to replicate the fabric-covered control surfaces. It worked quite well except for one or two spots where I got too heavy-handed with the sandpaper. Fortunately, these are on the underside."

His 62-inch-span airplane was built from Royal Mfg.* plans. The model has a full cockpit interior, a canopy and pilot figure from Top Flite*, a hand-carved static prop and working, three-piece flaps. Charles's model was part of a static display memorial at the Charleston Naval Air Station. Nice job, Charles.

Charles Brainard sent this photo of his nicely finished F4U-1 Corsair. He used the tape and primer method of duplicating the fabric-covered surfaces and says he's pleased with the result.

If any of you have used the techniques mentioned in "Scale Techniques," send me a picture of your model with an explanation of how you applied the technique, and I will show it in the column.

ME-163 KOMET PROJECT

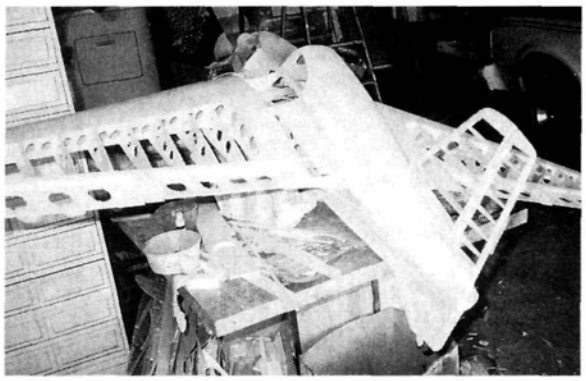
During the last months of the Second World War, Germany put many unusual designs into the final battles of the air war. The Me-262, the FW-190D-9 and the FW-Ta-152 immediately come to mind and have been modeled by many scale modelers. One of my favorites, however, is the Me-163 Komet, which has intrigued me for a long time.

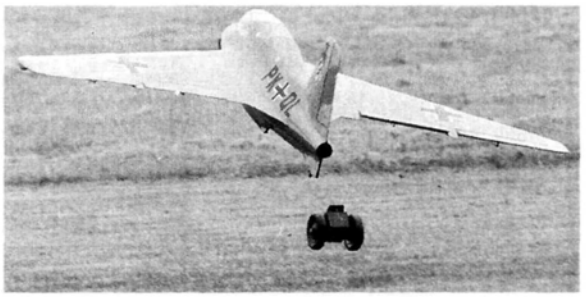
It was designed in 1939 by Prof. Alexander Lippisch as an experimental tailless glider with the potential for low- and medium-powered rocket-engine use. In 1941, the experimental Me-163V-1 reached a speed of Mach .84. With such promising performance, the Luftwaffe decided to continue the design's development and use it as a fighter. The Komet did not reach the Front until 1944, but by then, the War was all but lost. Problems with engine reliability and the fuel system—not to mention getting trained pilots—prevented the Me-163 from ever reaching its full potential.

Flying buddy Sal Calvagna let me fly his 82-inch-span Komet at the Warbirds Over Delaware gathering, and I was completely enthralled with this O.S. 1.08-powered model. I was even more impressed when Sal consistently landed the model straight down the middle of the field. Keep in mind that, as did the original, the model lands as a glider.

I knew immediately that I had to have one, but how and where would I find it?

As luck would have it, the Komet's designer, Jim Kiehl, was also at the Delaware warbird meet. After a brief introduction and a discussion of the model's construction, Jim explained much of the aircraft's history and told of how much success people have been having with Jim Kiehl Plans*. I ordered the plans from Jim on the spot, and I'm very pleased with them. Jim uses common-sense building practices, including a jig for fuselage alignment. The canopy and fiberglass cowl are available from Joe Saitta, (727) 398-4417. Joe informed me that he also cuts wood kits of the design, and I happily purchased a complete kit package.





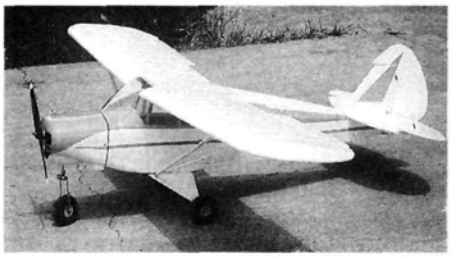
Above: here is Jim's 82-inch-span Komet under construction. I flew an O.S. 1.08-powered version of it and am very impressed with its speed and flying characteristics. Below: Sal Calvagna's Me 163 Komet is unusual and impressive. Here, we see Sal's giant gasoline-powered version at the Delaware warbirds meet at Lums Pond State Park. The model was designed by Jim Kiehl.

Jim and Joe work together to fill a niche market. I owe them a lot, since I now have a model kit I never thought I'd own. Isn't this hobby great?

IKON N'WEST

Emil and Iris Neely have designed and kitted giant-scale aircraft under the name Ikon N'West* for many years. Their product line mostly consists of ¼- and ⅕-scale civilian planes from the 1930s to the 1950s. Their kits are very complete and include hardware.

Two of their new offerings have me excited. One is a ¼-scale Piper Tri-Pacer. With an 87-inch wingspan and tricycle



Ikon N'West has a great-looking Piper Tri-Pacer that would make a wonderful first giant-scale project. Span is 87 inches, and it can easily be powered by a 4-stroke 1.20.

landing gear, it is an impressive aircraft.

The kit includes prebent landing gear, fiberglass cowl and handcut parts. The wing panels slide into place on brass tubes and are held in place with bolts from the inside of the cabin. With a flying weight of 12 pounds and 61 inches of flap, the Tri-Pacer should be a pussycat to land and should make an ideal first contest machine.

Also from Ikon are these pinking shears. They are just the tool for making scale rib-stitching tape for your next model.

Ikon also offers pinking shears specifically designed to cut strips of rib-stitching tape that are offered in 1/8-inch and 1/4-inch tooth pitches. Rib-stitching tape looks good on almost any "rag"-covered airplane. Check out their product line.

CUSTOM TRAILERS

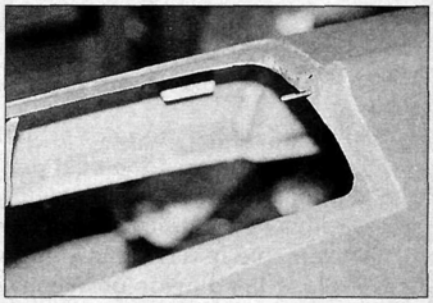
We have all seen trailers with fancy artwork on their sides. NASCAR fans identify with the numbers and colors of their favorite drivers' cars, and certain model-carrying trailers are becoming more and more visible on the modeling scene.

Darryl Usher of UEI* sent me photos of his new trailer, and it is emblazoned with painted pictures of F-100 and F-106 aircraft made from the kits he produces. The

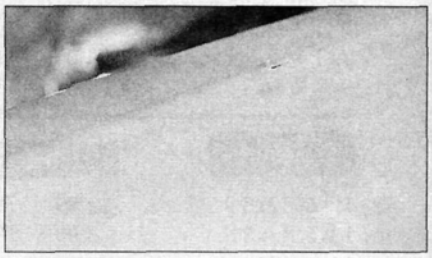
Everywhere you look these days, there are more and more custom trailers at flying meets. This one is Darryl Usher's of UEI. Darryl uses his trailer as a traveling trade booth to show off his wares to modelers he meets on the flying circuit.

TECHNIQUE OF THE MONTH

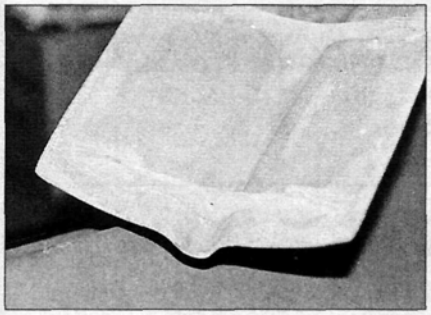
A little twist added to an otherwise ordinary building technique can add much to your model. Many scale modelers use a spring-loaded pin to hold hatch covers in place on their models. To open the hatch, the pin is pulled back with a small L-shaped wire that sticks out of a small slot next to the hatch cover—nothing really unusual, but the system works very well. I extended this spring-loaded pin by several inches on my Usher F-100 and placed the slot-and-wire release mechanism where there was a small antenna on the full-size aircraft. Now there is no obvious way to release the hatch cover, and the release wire looks as though it is supposed to be there.



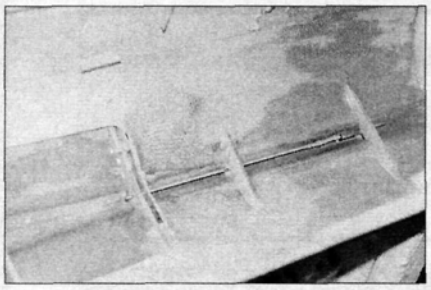
With the hatch removed, you can clearly see the latch pin, which is attached to an extension wire supported within the fuselage.



The barely visible L-shaped release wire protrudes from a slot cut into the fuselage skin. This slot is far away from the hatch opening to make the release wire less noticeable.

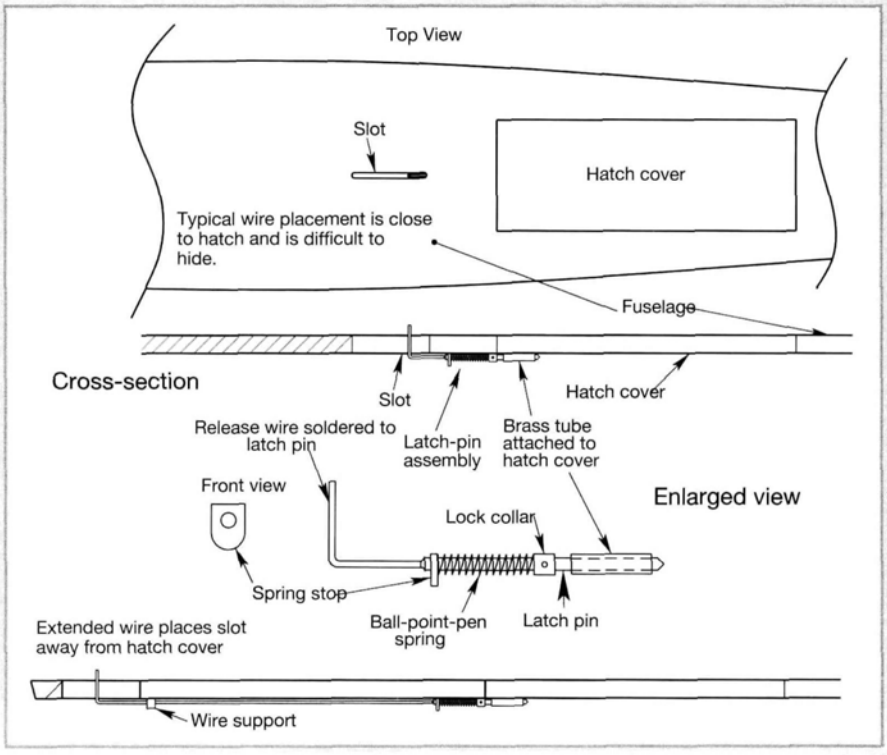


The underside of the hatch cover. The hole in the former accepts the latch pin and holds the hatch cover securely in place.



This is what the extended release-wire hatch-latch pin setup looks like.

This trick could also be used wherever a gun barrel exits the wing or the nose of a model. The release wire can be hidden inside one of the gun barrels, and the hatch could, if the release pin were long enough, be halfway to the tail or in the middle of the wing. Check out the illustrations and give it a try. Prebuilt hatch latch-pin mechanisms are available from Hobby Lobby Intl.* and Bob Violett Models*.



Art Muglia's trailer stands out from the rest because of the wonderful pictures he had painted on it.

trailer travels to jet meets and trade shows, and it also makes an ideal office with shelves and showcases for the presentation of his wares to prospective customers.

Friend and fellow modeler Art Muglia also has a new trailer, and it is hard to compare it to anything else ever seen. Art is building a ¼-scale B-25 and needed something larger than his station wagon to haul the 15-foot-wingspan, 12-foot-long model around.

It wasn't easy to find and customize the trailer, but it was probably much easier than painting it. Art contracted local artist Stuart Chalkley to paint pictures on the trailer's sides. The pictures show specific aircraft and are painted exactly to scale, including outline, color and markings. The paintings are so good that I may want Stuart to do my contest documentation!

When Art first flies his B-25, I'll be there to report on the event. I already know that he and his aircraft will arrive in style!

Our buddy Bob Banka has yet another updated version of his documentation catalog. If you're looking for scale aircraft info and documentation, get Bob's 1999 catalog.

SCALE MODEL RESEARCH

I don't know how many years I've known Bob Banka, but it has been a long while. His company, Bob Banka's Scale Model Research*, has grown to be *the* scale-model-documentation source. Each year, I look forward to the arrival of Bob's new "Aircraft Documentation and Resource Guide" because it is a great reference for all types of scale aircraft. The newest 228-page catalog lists more than 7,400 "Foto-Paaks" and 35,000 3-view drawings and includes 10 articles written by noted scale modelers. If you want 3-view drawings and photos for a project, contact Bob and discuss your documentation needs.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

PRODUCT NEWS

Latest product releases

INFORM YOUR CUSTOMERS! **Model Airplane News is interested in showing our readers your new products—here in Product News. If you'd like to see your products here, send us clear photos and a press release that provides information about them! We'll publish as many as space permits.**

Send your announcements to: Product News, Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

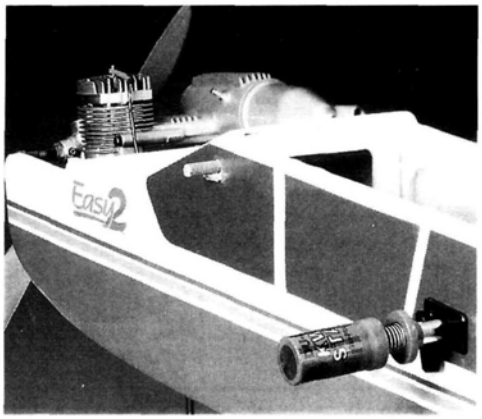
LESTER W. GARBER

Electric Autogyro

Powered by a Rocket 400 motor and 7-500AR cells, this direct-control autogyro weighs 18 ounces and has a rotor diameter of 35 inches. Typical flight time is about four minutes. The 36-page design and construction manual has 18 photographs and four pages of detailed CAD drawings.

Price—$15 (manual and plans).

Lester W. Garber, 2324 East 5th St., Duluth, MN 55812.



DU-BRO PRODUCTS INC.

Remote Safety Igniter

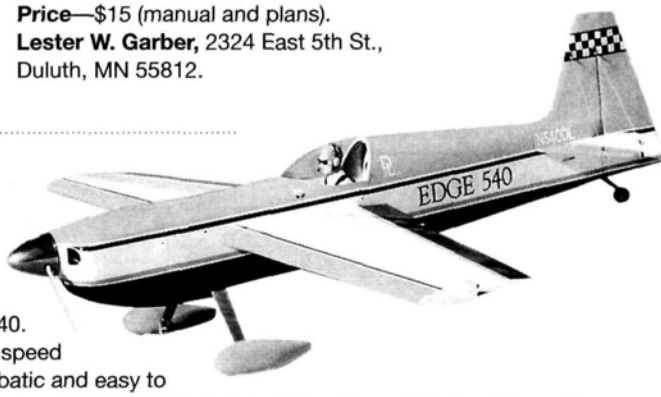
Du-Bro's new remote safety igniter can be installed in five minutes and fits anywhere on the model's fuselage. After the engine has been started, the igniter can be easily removed without going near the propeller. The small door shuts to keep dirt and debris out.

Part nos.—793 (for standard glow plugs), 794 (for recessed glow plugs); **price**—$8.95 each.

Du-Bro Products Inc., 480 Bonner Rd., Wauconda, IL 60084; (800) 848-9411 or (847) 526-2136; fax (847) 526-1604.

D&L DESIGNS

Edge 540



Three sheets of plans and a wood pack are now available for the ⅓-sport-scale Edge 540. The model has a wide speed range and is very aerobatic and easy to handle. The design incorporates a midship fuel-tank location, pull/pull rudder cable and spanwise variable airfoil design for good low-speed handling characteristics. Specifications: wingspan—80 inches; wing area—1,104 square inches; recommended engine—25 to 40cc; radio required—4-channel with six servos. The parts in the wood pack are laser-cut of Sig AAA balsa and plywood. Canopy, landing gear, fiberglass cowl, wheel pants and aluminum wing tube are available separately.

Prices—$25 plus $4 S&H (rolled plans and building notes), additional $80 (wood pack).

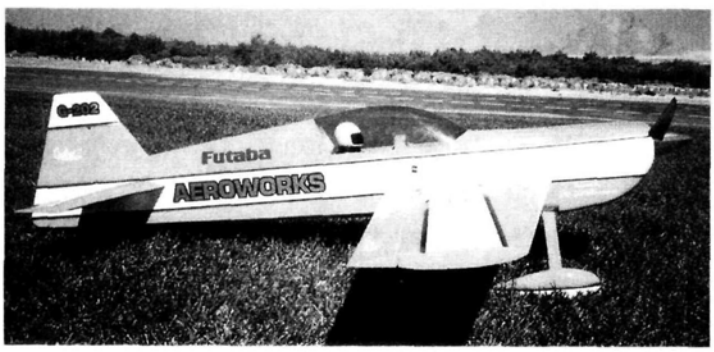
D&L Designs, 1145 E. Kleindale Rd., Tucson, AZ 58719; (520) 887-0771; email: dldesigns@mindspring.com; website: dldesigns.home.mindspring.com.

FUTABA

AVCS Gyro System

Futaba's new Active Angular Velocity Control System (ACVS) consists of the GY501 gyro and S9205 ball-bearing servo and uses silicone electronic sensors to eliminate the drift and heat sensitivity inherent to piezo gyros. Test results show the system has superior tail-holding power. Advanced controller/amp design allows parameters to be set on the built-in LCD without using external software, and a powerful custom microprocessor makes programming easy with all Futaba heli radios.

Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718; (714) 455-9888; fax (714) 455-9899.



AEROWORKS

40% Giles 202

Available in prebuilt and deluxe prebuilt versions, the Aeroworks Giles 202 has outstanding flight characteristics for pattern and freestyle events. The kit features lite-ply and balsa construction, a jig-built fuselage, presheeted wing, prebuilt and sanded tail sections, a foam turtle deck and hatch cover, a clear canopy, epoxy/glass cowl and wheel pants and detailed plans and instructions. Specifications: wingspan—106 inches; wing area—2,000 square inches; length—100 inches; weight—25 to 28 pounds; engine recommended—5.0 to 7.0ci.

Aeroworks, 401 Laredo Unit D, Aurora, CO 80011; (303) 366-4205.

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BUSINESS

R/C FLIGHT INSTRUCTION PLUS: go from beginner to instructor in one week; previous R/C flying experience not required. Using my proven "Ragland Technique" (at June '98 Grand Event). Within 7 days, I can teach you to skillfully fly R/C aircraft well enough to train others. Call or write: Clarence C. Ragland, 546 Niagara St., Lockport, NY 14094; (716) 434-7965. [4/99]

P-47 FIGHTER PILOT OFFICIAL TRAINING MANUAL: 96 pages of pictures and information about all switches, gauges, controls, etc. All you need to know about a P47. For copy, send $15 U.S. (foreign OK). Jim Matthews, 2324 W Hammer Lane, Stockton, CA 95209-2327. [6/99]

PATCHES, HAT TACS, BADGES: lapel pins, embroidered patches, name badges, logo-imprinted items. Low minimums. Generation Products Co. (800) 472-5155. [4/99]

MINI-BOLT: standard and metric fasteners, drills, taps, dies, ball drivers, hardware. *Mail-order catalog*—$2. Esseltine Enterprises Ltd., 691 Fife's Bay Rd., Peterborough, Ontario, Canada K9J 6X3; phone/fax (705) 876-8645; email: suee@ptbo.igs.net. [6/99]

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LARGE-SCALE SAILPLANES AND TOWPLANES—new and used. Call (212) 879-1634; Sailplanes Unlimited, 63 East 82nd St., New York, NY 10028; www.sailplanes.com. [4/99]

PLANS—R/C sailplanes, scale, sport and electric. Old-timer nostalgia and FF scale and sport-powered, rubber and towline. *All models illustrated. Catalog $2. Cirrus* Aviation, P.O. Box 7093, Depot 4, Victoria, BC V9B 4Z2 Canada. [5/99]

SEMI-RETIREMENT SALE - BRIDI AIRCRAFT. Have many kits in stock of favorite designs. Good prices. Send SASE for free brochure of remaining aircraft in stock to 23625 S. Pineforest, Harbor City, CA 90710; (310) 549-8264 or (310) 326-5013; fax (310) 549-8268. [4/99]

OBECHI VENEER, premium grade sheets, 1/32"x12"x132" long—$8.50 U.S. +S&H, more sizes available. We manufacture 15 glider kits ranging from hand-launch to 5-meter scale. Hitec dealer. 10-meter rolls of Ultracote. Send $0.60 in postage for our photo-illustrated catalog to Dream Catcher Hobby Inc., P.O. Box 77, Bristol, IN 46705 or see our Web page at http://www.dchobby.com. To order, call (219) 523-1938; we accept Visa/MC. [7/99]

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Congratulations to Thracy Petrides, of New York, NY, for correctly identifying the January '99 mystery plane. This odd-looking, wingless craft, called the "GE Gyro-Glider," was developed in 1946 at General Electric's flight test center at the Schenectady, NY, County Airport and was the predecessor of today's gyrocopter. In the photo, Igor Bensen, one of the GE engineers responsible for the Gyro-Glider's design and development, flies the Gyro-Glider as it is towed by a jeep. The craft, which worked like an autogyro without power, was capable of lifting nearly 300 pounds in addition to its own weight and could land in extremely small areas.

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MODEL AIRPLANE NEWS HOW TO

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BY CHRIS CHIANELLI

Scale to the core

The General Dynamics F-16 was the first fully "fly-by-wire" fighter. The Fighting Falcon and so many other modern jets like this rely heavily on computer electronics for their incredible maneuverability. It's also the reason pilots can fly these otherwise inherently unstable hotrods of the gods.

Before I even begin my tirade, I would like to point out that I don't even use dual rate on my scale Spacewalker. Personally, I don't believe it's appropriate. When it comes to scale jets, however, my feelings on electronically assisted flight can be characterized as diametrically opposed to the preceding statement. Take, for example, the ever increasing availability, dependability and all around safety of the production micro turbine. Because of their increasing popularity, R/C jets are not only sounding full-scale, but they're smelling it, too!

I guess it's obvious where I'm going with this. It's quite timely that, while model jet powerplants are emulating their full-scale counterparts to the tee, available electronic equipment, like piezometric gyros, are at the same time getting smaller, cheaper and better in terms of response time and current drain. In my humble opinion, I believe such electronic equipment is not only appropriate for scale R/C models of today's high-tech jets but, moreover, should be allowed at R/C scale events on any axis where similar electronic assist was employed on the full-scale craft being modeled.

Frank Tiano, creator of the world-class Top Gun Scale event, and I go way back. When I was in college and had no place to build, Frankie gave me the use of half his cellar and all the glue and coffee I could consume. We are, to say the least, very close friends. Therefore, when he's being pigheaded, the job of telling him so rests with me. This duty calls, by the way, at least a half dozen times a year. I called him to discuss the subject of electronic assist on models of modern jet subjects at future Top Gun events. His response? "I allow them on yaw—that's it! That's enough!" My response was to ask him this simple question: "Frankie, is it not the prime directive of all Top Gun contestants to re-create a given full-scale subject to the highest degree in every possible way?"

Silence roared like thunder from the other end of the phone. You see, I've never known Frankie to be at a loss for words in the 27 years I've known him. Finally, the silence was broken by, "... ah ... lunch is ready; I'll have to get back to you." Frankie always did know when to break off the battle so as to regroup for the future offensive. In the final analysis, whatever that might be, I know Frankie will do what he believes in his heart is best and fair for all who compete at Top Gun.

Contests notwithstanding, the movement has started and no one can stop it. As you read this, a well-respected figure in the jet world, whose name I won't mention because it goes against his perfectionist nature to discuss a project until per-fected, is equipping a twin turbine power model with sufficient piezo crystal gyros such that the famous Russian MiG 29 "Cobra" maneuver will be within the model's capabilities. Considering the twin turbines, I wonder if one of those gyros will be dedicated to differential thrust vectoring? Something to think about. ✈

Here's a look into the future of R/C. These canisters, which are about the same size as an eraser body on a pencil, are the piezometric crystal gyros found on the intriguing AFOT (Area Fifty One Technology) Roswell Flyer featured in "Air Scoop" this month. These gyros have no moving parts, have a low current drain, are lightweight and are getting less and less expensive. The writing is on the wall, or more like chiseled in.

My personal favorites are the tailless delta-wing designs from the age of the Century Series jets—beautiful machines like Convair's B-58 and F-106 (above). While these older jets certainly weren't "fly by wire," they did have early types of electronic axis damping. Often, models of tailless delta-wing subjects are somewhat "loose" around the roll axis at high speeds. One little gyro wouldn't hurt—would it?